Rio Blanco Oil Shale Project

SEMI-ANNUAL REPORT 1977
INTERIM STUDIES
MARCH, 1977

Gulf Oil Corporation

and Standard Oil Company (Indiana)

5460 East Hampden Avenue, Denver, Colorado 80231

RIO BLANCO OIL SHALE PROJECT
INTERIM STUDIES
SEMI-ANNUAL REPORT

SUBMITTED TO
RIO BLANCO OIL SHALE PROJECT
DENVER, COLORADO

SUBMITTED BY
ECOLOGICAL SCIENCES DIVISION
NUS CORPORATION
PITTSBURGH, PENNSYLVANIA
HOUSTON, TEXAS
AND
DENVER, COLORADO

MARCH 31, 1977

PREPARED BY: Thomas M. Ivory
Thomas M. Ivory
Project Manager

APPROVED BY: Paul V. Morgan
Paul V. Morgan
Vice President and General
Manager
Ecological Sciences Division

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

In January 1974, Standard Oil Company of Indiana and Gulf Oil Corporation were jointly awarded the lease bid for a federally owned oil shale tract in northwestern Colorado (Tract C-a). They subsequently formed the Rio Blanco Oil Shale Project (RBOSP) to direct the prototype oil shale development effort for this tract. Before they began exploratory activities on the tract, RBOSP signed a lease agreement (Federal Register, Volume 39, Number 230) which required, in addition to various geotechnical studies, an extensive 2-year environmental study to establish environmental baseline conditions. This study began in October 1974 and included the disciplines of climatology and air quality, water quality, hydrology, aquatic ecology, terrestrial ecology and cultural resources. During this 2-year period, a detailed development plan for extraction of oil shale ore by open pit mining methods was prepared by RBOSP and issued for public review and comment.

In September 1976, RBOSP was granted a suspension of operations for one year. During this suspension period, RBOSP was required to conduct interim environmental studies to maintain continuity of data gathering on critical parameters of the environment. The purpose of the interim environmental study was to further explore identified problem areas, to provide the Government and the Lessee with further knowledge of environmental conditions on the lease tract and to permit rapid commencement of operations at the end of the suspension period.

The data collected during the interim environmental studies will be used to develop plans for future monitoring studies once site development has commenced.

This report describes the interim environmental studies conducted since the onset of suspension and presents data collected during the first six months of the program.

Objectives and methods for each discipline are described. However, most data presentations will be made in the second semi-annual interim studies report, since only limited field studies have been conducted to date.

The interim environmental studies are divided into several technical disciplines and include: atmospheric studies, hydrology, aquatic biology and terrestrial biology. Meterological and air quality conditions are being measured at only one station. Hydrological studies include finalization of 85 Mesa studies, plus continued monitoring at selected USGS stations and monitoring holes.Precipitation chemistry has been added to the program. Aquatic biology is studied at three stations only and includes periphyton and benthos. Terrestrial biology studies include mule deer, small mammals, range and browse, breeding birds and sandhill cranes.

INTRODUCTION

RBOSP interm environmental studies include four technical disciplines:

- Atmospheric Studies
- Terrestrial Studies
- Hydrological Studies
- Aquatic Studies

Each of these technical disciplines is discussed in the following report in the order listed above. Specific objectives are presented followed by a discussion of specific methods used to attain these objectives.

Where applicable, data collected during the interim program to date, are presented and discussed.

Data from air studies are limited to one month for the interim sampling and discussions of data for this discipline are limited. Range and browse plots have been set up but no data are available as yet. Mule deer pellet plots were established, but small mammal sampling has not yet been conducted; nor has the sandhill crane survey. Scheduled field work is indicated in Table 1. Complete data presentation will follow the end of the suspension period.

Hydrology studies have continued during the suspension, including water quality at selected USGS gaging stations and alluvial and groundwater quifers. Aquatic biotic data were collected during December at three sites. Results were compared to baseline data for the same month.

TABLE 1

RBOSP INTERIM STUDIES TASK SCHEDULES

Activity	Mo. Wk.	Nov. 1234	Dec. 1234	Jan. 1234	Feb. 1234	Mar. 1234	Apr. 1234	May 1234	Jun. 1234	July 1234	Aug. 1234	Sept. 1234
Scope of Work Preparation												
Scope of work and Contract approval												
Field Studies												
Atmospheric												
Terrestrial												
Range Production & Utilization							x (Set up plots)				x	
Browse Condition & Utilization			x					x			x	
Mule deer			x (Set up plots)					x			x	
Small mammal								x				
Breeding bird								x				
Sandhill crane							(2 weeks)					
Hydrology 1/												
Surface water gaging stations												
Water quality							x					
Alluvial groundwater			x				x					
Deep groundwater			x				x					
Monitoring wells												
Aquatic biology			x				x					
Data Analysis												
Baseline data												
Planning & Coordination												
Review												
Analysis & Correlation												
Interpretation												
Interim data												
Analysis & Correlation												
Interpretation												
Reports												
Interim Monitoring												
Monthly			x	x	x	x	x	x	x	x	x	x
Semi-annual							▲					▲
Final Baseline Reports												
Review												
Atmospheric												
Aquatic												
Terrestrial												
Soils												
Cultural Resources												
Hydrology												
Integration												

[1]To be conducted by WWE and USGS

SECTION I - ATMOSPHERIC STUDIES

The two year air quality baseline measurement program was completed at the end of January 1977. Air studies will continue during the oil shale lease suspension under an Interim Air Monitoring Program.

CHAPTER 1 - AIR QUALITY AND METEOROLOGY

1.1 OBJECTIVES

The objectives of the interim environmental monitoring programs are:

- acquire meteorology and air quality data for the period February 1, 1977 through August 31, 1977.
- identify conditions under which anomalous data have been acquired during the entire monitoring period.
- specify in greater detail the natural climatic, meteorological and air quality environment on the tract.
- establish the basis for revision of the detailed development monitoring plan to improve the selection of monitoring parameters to insure the accurate assessment of the trace area environment with the minimum expenditure of resources.
- integrate baseline and interim data into a consolidated assessment report.

1.2 METHODS

A comparison of gaseous pollutant concentrations measured during the two year baseline monitoring program showed that no significant differences occurred among the data from the four monitoring sites. This result might

have been anticipated since there are no significant non-natural sources of the pollutant monitored for considerable distances in any direction from the site. The pollutant concentrations measured were a combination of the remnants of pollutants introduced into the air mass at considerable distances from the site, and those pollutants that are the result of natural processes.

During the interim studies monitoring program one monitoring station, containing instrumentation for the continuous measurements of SO_2, H_2S, NO, NO_x, CO, O_3, CH_4 and THC is being maintained operational. The instrumentation is located at monitoring Site 1, just outside and generally upwind of the western tract boundary. The other three baseline monitoring stations have been placed in a standby condition and will be reactivated when site development activities are initiated. The data acquired during the interim monitoring program will be used to supplement the baseline data set and will be used in an attempt to clarify certain questions about the origin of elevated pollutant concentrations measured during the baseline program.

The ambient air concentrations of most pollutants measured on or near Tract C-a most of the time are near or below the reliable threshold of detection of the automated instruments used to make the measurements, even though the instruments represent the current state of the art in pollutant monitoring. To provide a parallel measurement with greater sensitivity and precision a series of wet chemical determinations will be made to compare with the automated instrument readings. The wet chemical sampling will permit the collection of integrated samples over sufficient periods of time to reduce the effects of instrumental noise on a concentration measurement. Wet chemical determinations can be made for concentration of SO_2, H_2S, NO, NO_x and O_3.

The one pollutant which did show significant site to site variation was the concentration of suspended particulate. The reasons for the variations are discussed later in this report. During the interim monitoring program, suspended particulate samples are acquired with a pair of high volume samplers every third day. Two samplers are used to collect simultaneous samples from ground level (1.5 m) and 7m above the ground. Review of the baseline data

shows that the suspended particulate data from Site 1 undergoes relatively few upsets. Particulate filter control is being held to rigid standards in order to verify or explain previously obtained extremely low measures of 24 hour average suspended particulate levels.

Near the termination of the baseline data acquistion period, Site 1 was audited as a part of the EPA Quality Assurance program for the Western Energy Area. Recommendations resulting from the findings of this audit are being integrated into site operation and maintenance procedures. The purpose of the audit was to assist in validating montoring data from various energy projects so that data are certifiable as accurate and comparable even though they may have been collected by different instrumentation or methodologies. During this same period the federal EPA established a new measurement principle and calibration procedure to replace the existing reference method for the measurement of nitrogen dioxide in the atmosphere. This new calibration procedure will be adopted for use with the nitrogen oxides detector of the monitoring site.

The meteorological instrumentation on the 60 m tower is also being maintained during the interim monitoring program. This instrumentation includes temperature wind speed and direction at three levels (10 m, 30 m and 60m). Relative humidity, wind sigma, differential temperature (10 m - 60 m), solar radiation and precipitation gages are also in operation at the monitoring site.

1.3 RESULTS

Three air quality parameters examined and monitored in greater detail to determine the origins of elevated concentration levels include:

(a) Atmospheric suspended particulate concentrations have occasionally exceeded federal and state standards at some of the monitoring sites during the baseline period. The occurrence of elevated levels correlates very weakly with local wind speed and humidity. The elevated levels, however, correlate very strongly with day of the week, rising on Friday, Saturday and

Sunday. Gross violations of standards occur only during the local hunting season, and are site specific with Site 4 showing concentrations 5 to 10 times greater than sites 1 or 2 which are somewhat less accessible to the public. An access road passing site 4 is on the northeast side of the monitoring site and daytime wind flows at site 4 are such that dust raised by traffic on this road will be transported toward the monitoring station from at least a one mile stretch of road.

(b) Non-methane hydrocarbon concentration at several monitoring sites has occasionally exceeded the federal 3-hour standard (6-9 AM). This phenomenon has been noted in the past from monitoring at other shale tracts, and has been ascribed to various sources, including vegetation. Selected vegetation samples have been collected in an attempt to determine whether this source is a reasonable explanation. Chromatographic analysis of samples are to be acquired to attempt to identify the specific hydrocarbon components present since the conventional site instrumentation acquires only a monspecific total hydrocarbon measurement. Since the non-methane hydrocarbon concentration during the baseline period exhibited a diurnal variation, the effect of solar heating and cooling on the ground surface and the possibility of the periodic release of volatile compounds from surface rocks is also to be investigated.

(c) Ozone concentrations have also occasionally exceeded federal and state standards. More detailed information on natural ozone production at higher elevations under strong solar illumination with minimal atmospheric particulate loading and scavenging will be acquired. In addition, the regional synoptic weather patterns which have been shown to result in a downwash of tropospheric ozone will be monitored closely to determine whether this effect is responsible for observed elevations in concentrations.

During an analysis of a portion of the baseline meteorological data set, the question of the representativeness of the differential temperature (10-60 m) measurement in estimating the atmospheric stability on the site arose. The placement of the tower on a knoll with a relatively high surface albedo may result in certain artifacts which may affect stability estimates during

portions of the day when the surface is undergoing rapid cooling and a strong drainage flow away from the tower occurs. Alternate measures of the lapse rate will be made to detect any effects due to the site specific characteristic.

The baseline data period was one of recognized anomaly in the lack of precipitation of all forms. An attempt will be made to estimate the impact of this parameter on other meteorological factors, so that future site development effects in relation to normal conditions may be more accurately evaluated.

Investigations of these parameters will continue during the interim program. Less than one month of interim data was collected during this study period, therefore no data are reported in this report. All data collected during the interim program will be submitted with the next semi-annual report.

CHAPTER 2 - USGS PRECIPITATION DATA

2.1 OBJECTIVES

The objectives of the studies are to gather additional precipitation data during the interim monitoring period.

2.2 METHODS

The USGS has installed six rain gaging stations. Three of these stations are of the storage type gages; precipitation is collected and hand measured at regular intervals. These three are associated with surface gaging stations at Dry Fork, Box Elder and Corral Gulch near the west boundary of the tract. The remaining three rain gages record both cumulative precipitation as well as precipitation rate, for example, inches per hour, for individual storms. One of these is located west of the tract near the drainage divide of Cathedral Bluffs. The second is located at the surface gaging station near the mouth of Yellow Creek. The third is located at the Stake Springs Draw surface gaging station shown on Figure 1 .

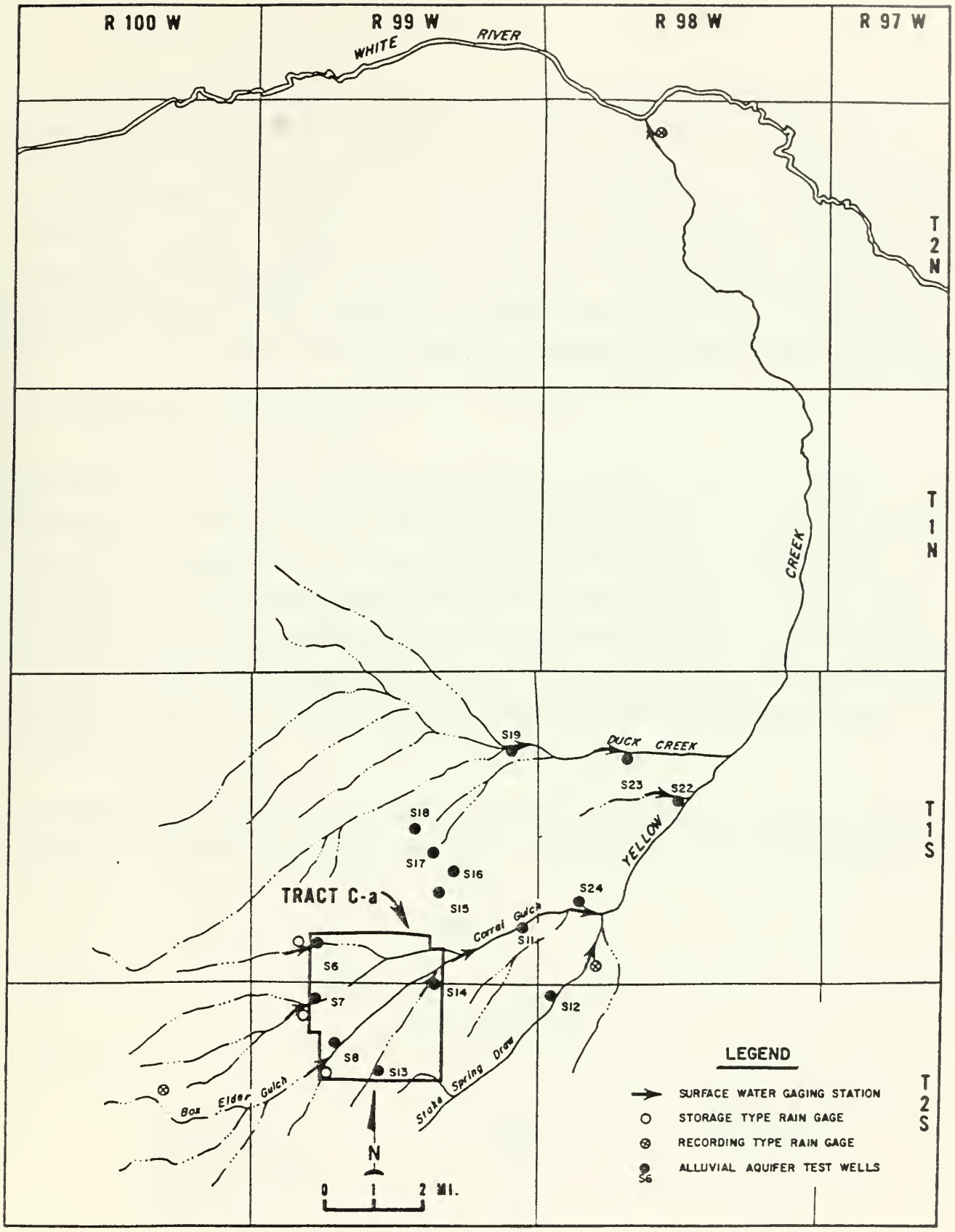

FIGURE 1

SURFACE WATER GAGING, ALLUVIAL
HOLE LOCATION

It should be noted that the precipitation gages, both those of the USGS and those installed by the environmental contractor, are highly variable as to location and surrounding terrain, elevation, and exposure. In order to equalize the difference in wind velocities at each of the sites, wind shields have been put up around each precipitation gage. As prevously noted, there are recording and storage-type precipitation gages. The storage-type gages are more likely to experience evaporation losses before a reading is taken than are the recording-type stations where the readings are taken almost immediately.

2.3 RESULTS AND DISCUSSIONS

The results of the USGS interim monitoring program are shown on Figures 2 through 7 . For the period from October 1 through March 1, the data indicate that the precipitation is far below normal. During the baseline program, the precipitation averaged approximately one inch per month. The data from the interim monitoring program indicates that less than .925 inch of precipitation has been the average monthly total. The month having the most precipitation was January 1977, and the month having the least precipitation was November 1976.

A comparison of the USGS Stake Springs recording precipitation gage with the RBOSP site 3 precipitation gage was made. The results are shown on Table 2.

TABLE 2

COMPARISON OF PRECIPITATION
AT TWO STATIONS
(Inches per month)

	USGS Stake Spring	RBOSP Site 3
October 1976	0.28	0.26
November 1976	0.08	0.00
December 1976	0.10	0.06
January 1977	0.51	0.39

The two stations were selected for comparison because of their relative location and elevation. With the exception of January, 1977, the results of the

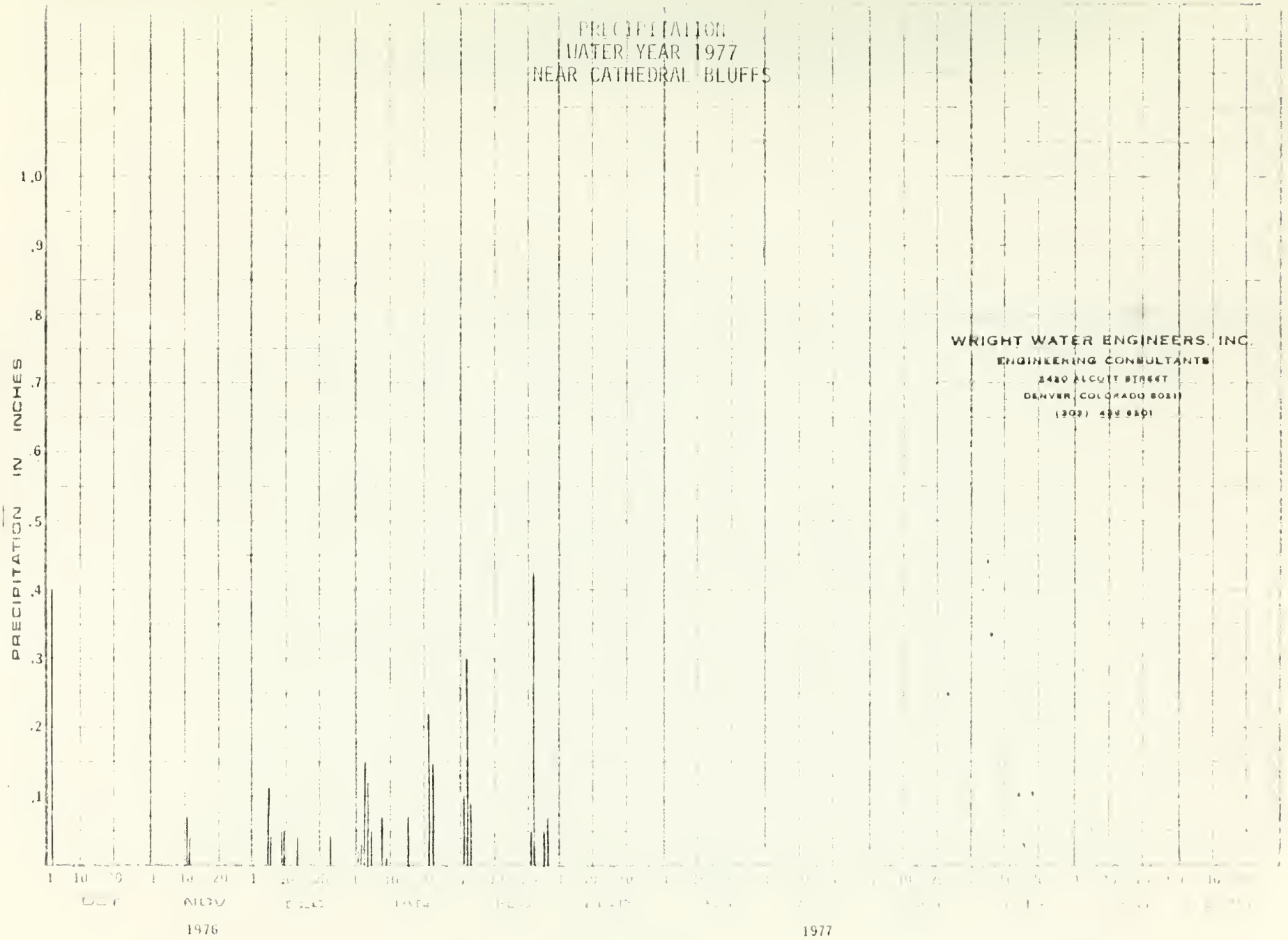

FIGURE 2

USGS PRECIPITATION DATA FOR CATHEDRAL BLUFFS STATION, RBOSP

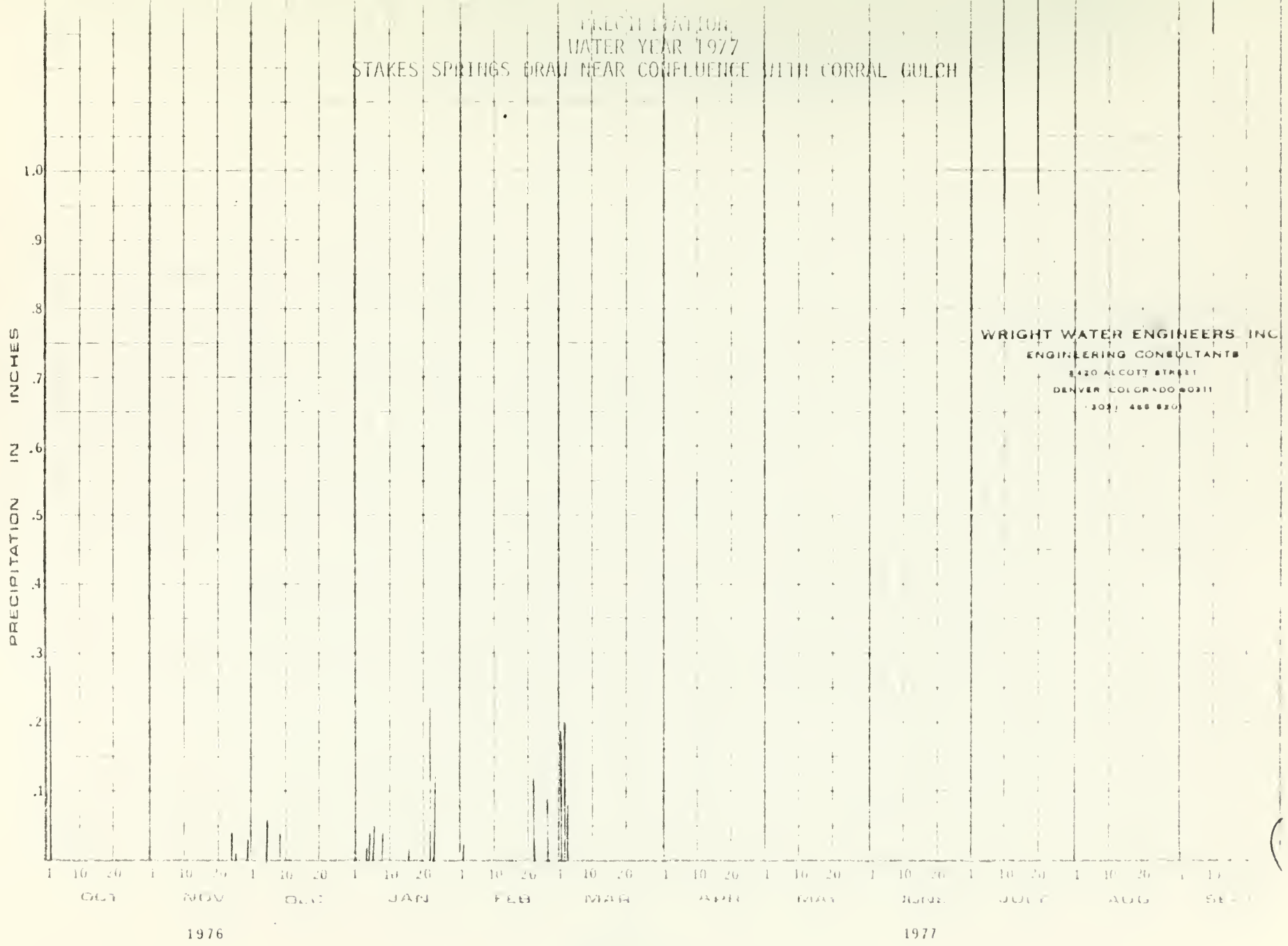

FIGURE 3

USGS PRECIPITATION DATA FOR STAKES SPRINGS DRAW (NEAR CONFLUENCE WITH CORRAL GULCH), RBOSP

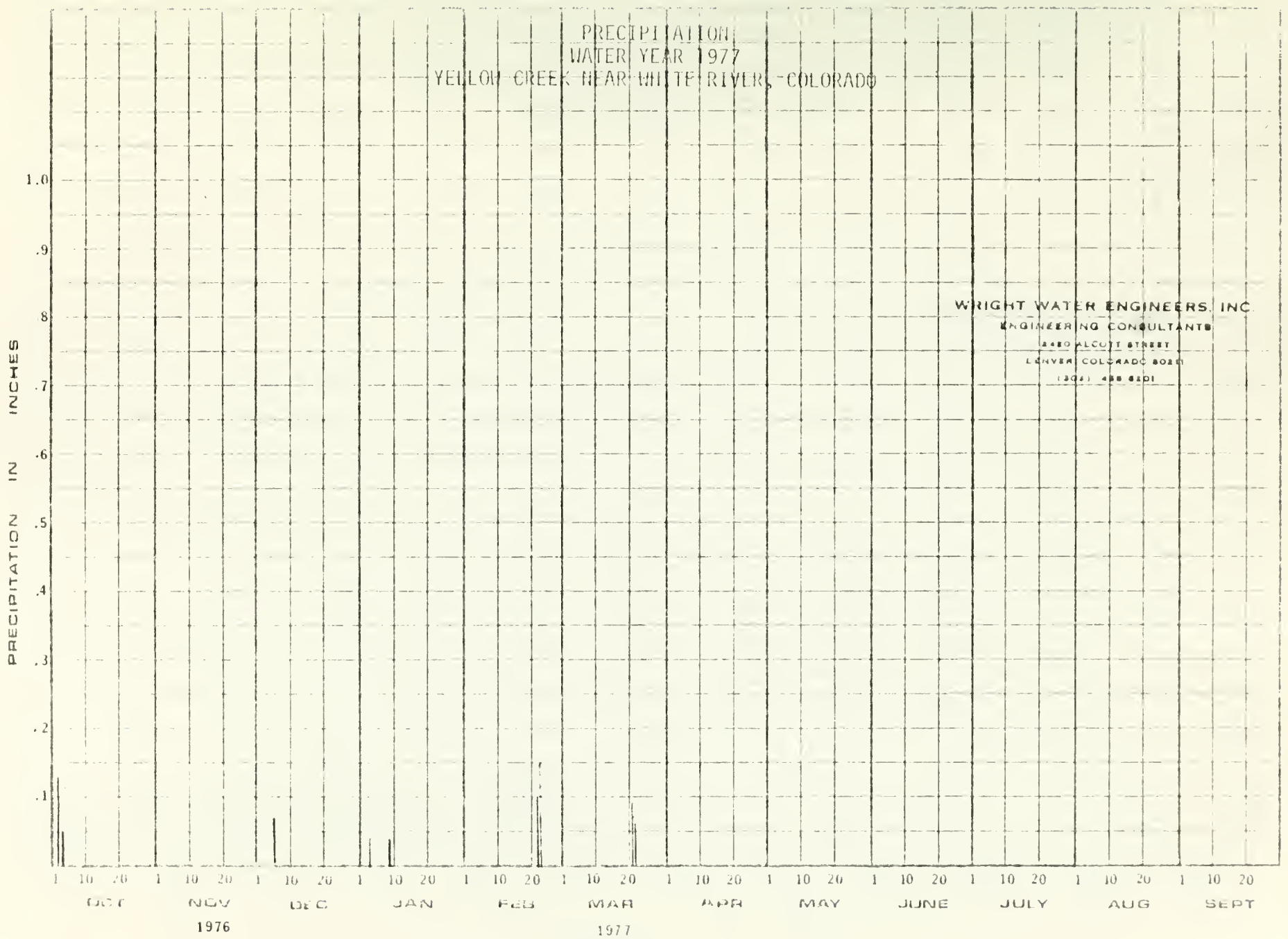

FIGURE 4

USGS PRECIPITATION DATA AT YELLOW CREEK STATION NEAR WHITE RIVER, RBOSP

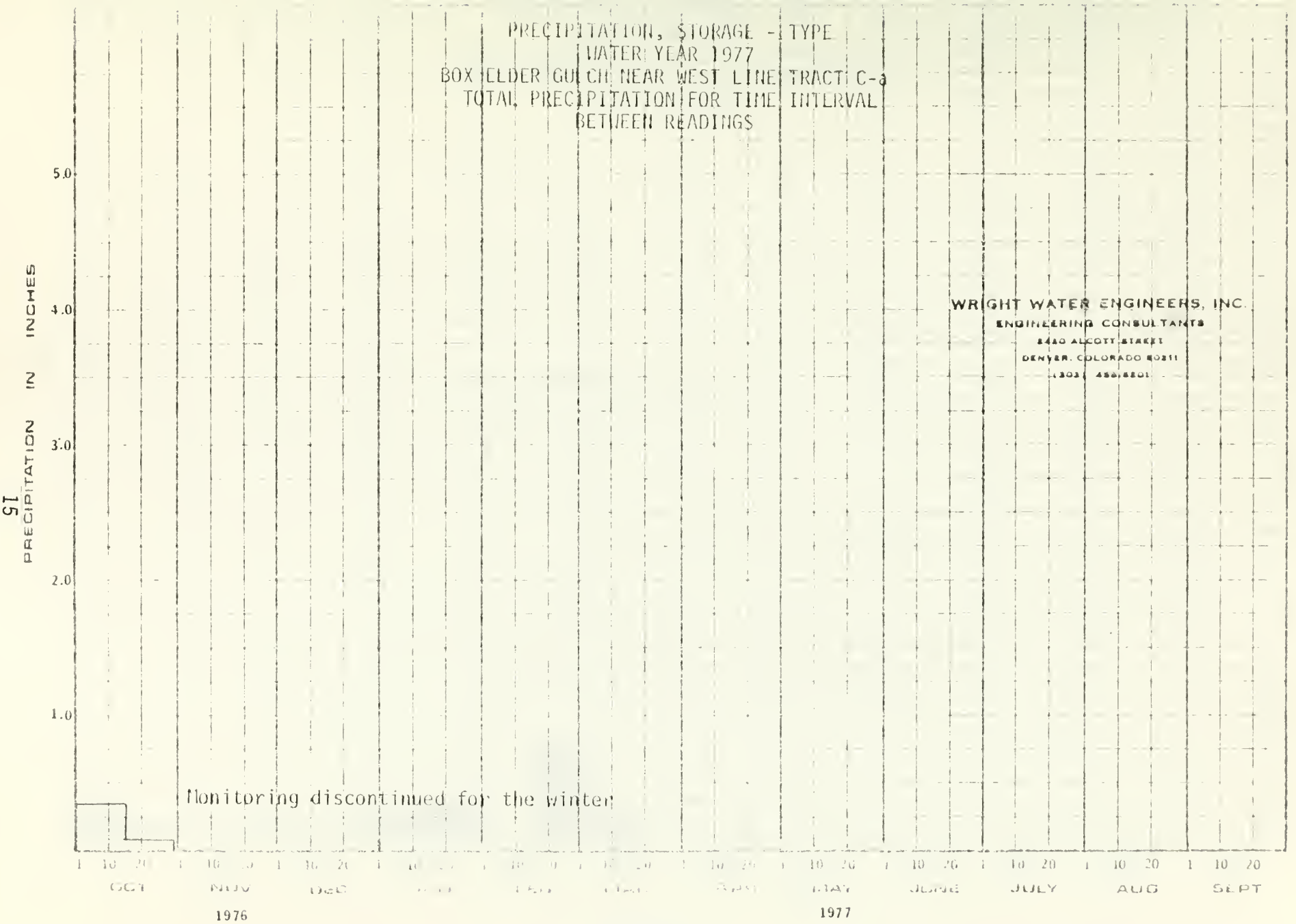

FIGURE 5

USGS PRECIPITATION DATA FOR BOX ELDER GULCH, RBOSP

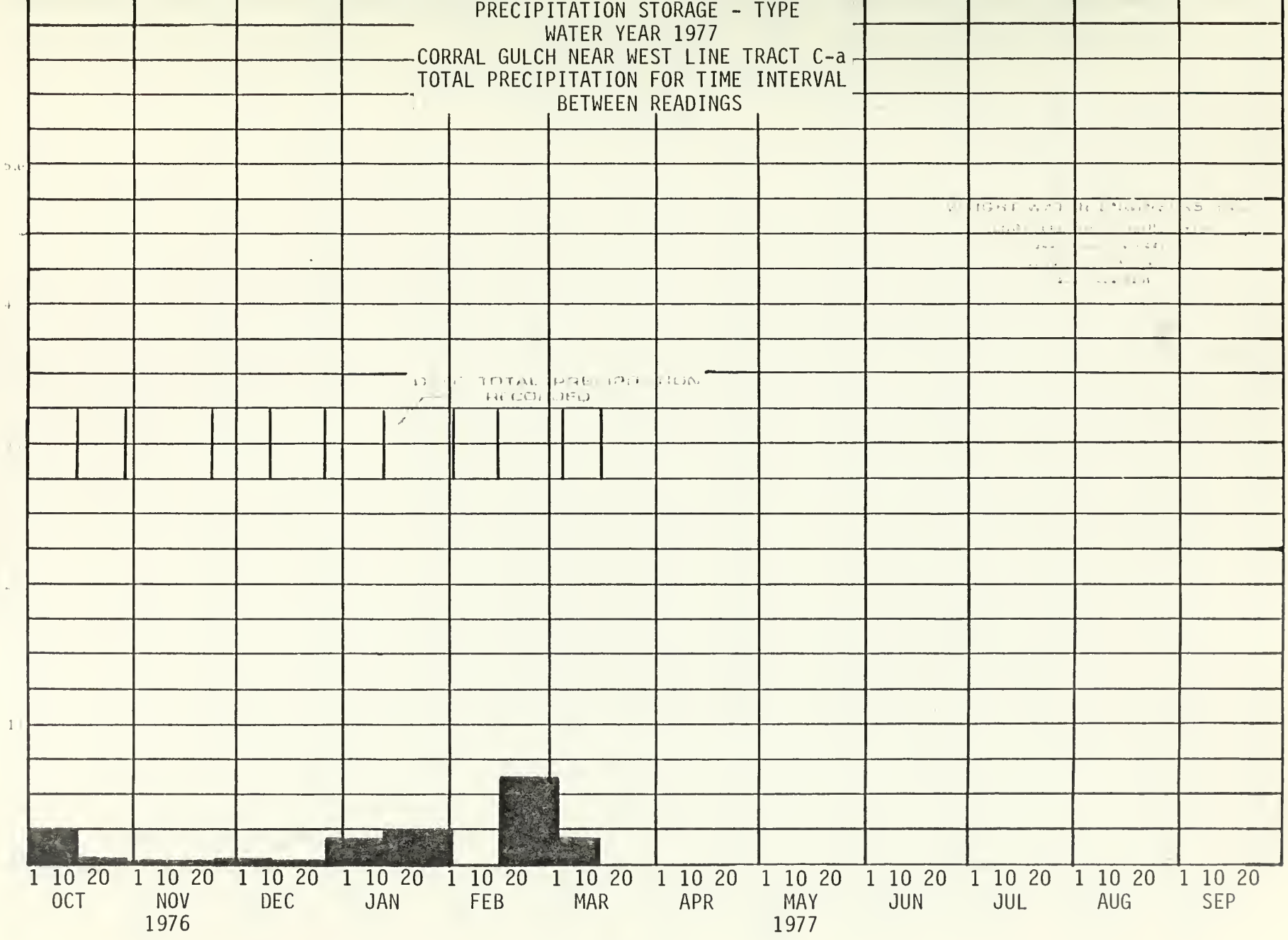

FIGURE 6

USGS PRECIPITATION DATA FOR CORRAL GULCH (WEST LINE), RBOSP

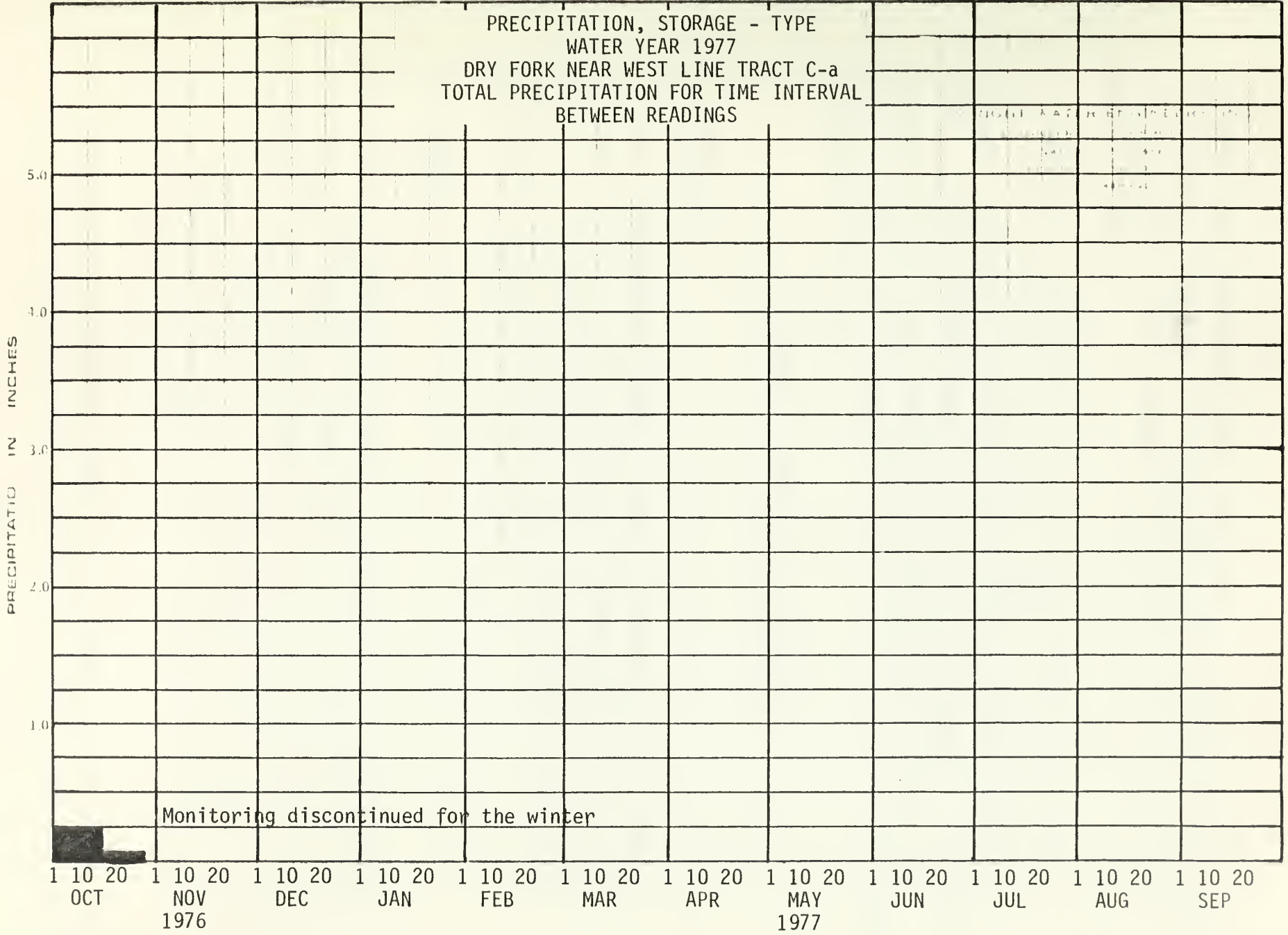

FIGURE 7

USGS PRECIPITATION DATA FOR DRY FORK (WEST LINE), RBOSP

data from the two stations indicate nearly identical precipitation on a month by month basis. The 0.12 inch of precipitation for the month of January is probably a real difference between the two stations due to the local differences mentioned.

In summary, the precipitation during the interim program since October 6, 1976, is far below normal as is the case regionally within the state of Colorado. During this period, the data collected by the USGS and by Rio Blanco Oil Shale Project appears to be in very close agreement. All stations indicate that there were no major storms during the period and that the month of November 1976 was the dryest month since the first data was collected on and around Tract C-a.

CHAPTER 3 - PRECIPITATION CHEMISTRY

3.1 OBJECTIVES

In order to determine the chemical makeup of precipitation which falls on and around Tract C-a, a pilot data collection program has been initiated during the interim suspension monitoring. This program will collect two samples; one from a snow storm and a second sample from a thunder shower precipitation type event during the summer.

3.2 METHODS

The method for collecting the samples is dependent upon whether the sample is a snow or rain sample. The snow sample is to be collected by gathering freshly fallen snow off the ground and putting it into containers and allowing it to melt. It should be noted that the containers and all of the equipment used to handle the sample are first cleansed using distilled water. As soon as the snow samples melt, they are poured into special nalgene containers which are reported to be inert.

It is proposed that the summer thunderstorm rain samples will be collected using the same containers that the snow melted in. These containers, how-

ever, will be placed in the field with wood support structures. The lids from these containers will be removed allowing the containers to fill or partially fill with precipitation. If more than one precipitation event is required, the containers will be closed until the next precipitation event occurs. It should be noted that the closed container will be sealed as well as can reasonably be done.

Standard wet chemistry analysis and atomic absorption with appropriate detection limits for the following constituents will be conducted: arsenic, cadmium, chromium, copper, lead, molybdenum, mercury, selenium, bromide, calcium, chloride, magnesium, potassium, sodium, iron, pH, fluoride, sulfate, total dissolved solids, bicarbonate, carbonate, total nitrogen which is nitrate plus nitrite, and silicon dioxide.

SECTION II - TERRESTRIAL STUDIES

The interim program was initiated in November of 1976 to monitor selected terrestrial biota during the lease suspension period. Since that time a scope-of-work has been developed for monitoring range and browse conditions, mule deer, small mammals, avifauna and threatened and endangered faunal species. Field studies of browse condition and mule deer were initiated in December of 1976 and will be repeated in spring and fall of 1977. Small mammal, avifauna and threatened and endangered species programs will be conducted in the spring of 1977 and range conditions will be assessed in the fall of 1977.

The interim terrestrial programs are monitoring sagebrush, pinyon-juniper and mixed brush habitats primarily on Tract C-a. To facilitate data comparisons faunal sampling sites, except for the endangered species studies, are located in the general vicinity of the range and browse sampling sites. Terrestrial interim field studies will be completed in August and the results will be reported in September of 1977.

CHAPTER 1 RANGE PRODUCTIVITY AND UTILIZATION

1.1 OBJECTIVES

Range productivity and utilization studies will be conducted to measure the actual forage being produced annually per unit area and to measure use forage by large herbivores in the area. These studies will indicate the current carrying capacity of the area and the degree to which herbivores have consumed current vegetation.

1.2 METHODS

Range productivity and utilization studies will be conducted within the three principal vegetation types on Tract C-a and the 84 Mesa study area: pinyon-juniper, sagebrush and mixed brush. Thirty sampling sites (pinyon-juniper - 10; sagebrush - 15; and mixed brush -5) will be established in April of 1977

in the general vicinity of the browse plots (Figure 8). These sampling sites will occur on a variety of slopes, aspects and elevations within a particular vegetation type.

Range productivity and utilization estimates will be obtained by using the double sampling method (USDA Forest Service, 1970). Two protected plots (0.9 m^2 each) and eight unprotected plots (permanently marked) will be located at each sampling site.

In sampling, a 0.9 m^2 sampling loop will be placed at 10 m intervals on each of eight unprotected plots. An ocular estimate will be made of production (weight to the nearest gram) of grass and forb species within the loop. The two protected plots will be similarly estimated. Each species within the protected plots will then be clipped, bagged separately, weighed green and the weights recorded. Species providing less than one percent of the biomass will be recorded as present, but will not be weighed. Correction factors will be calculated from the estimated green weights and actual green weights of the clipped plots.

$$\text{CORRECTION FACTOR} = \frac{\text{Actual Green Weight}}{\text{Estimated Green Weight}}$$

This correction factor will be used to correct all estimated values. Clipped samples will be air-dried for approximately 30 days and weighed to obtain moisture percentages. Air-dry forage productivity estimates will then be computed from the moisture percentages and corrected estimates.

Percent utilization will be calculated as follows:

$$\text{\% Utilization} = \frac{\text{Average productivity per ungrazed plot} - \text{Average productivity per grazed plot}}{\text{Average productivity per ungrazed plot}} \times 100$$

Field measurements will be made at the end of the growing season in August of 1977. During the range productivity and utilization studies range habitat will be usually inspected for insect and frost damage.

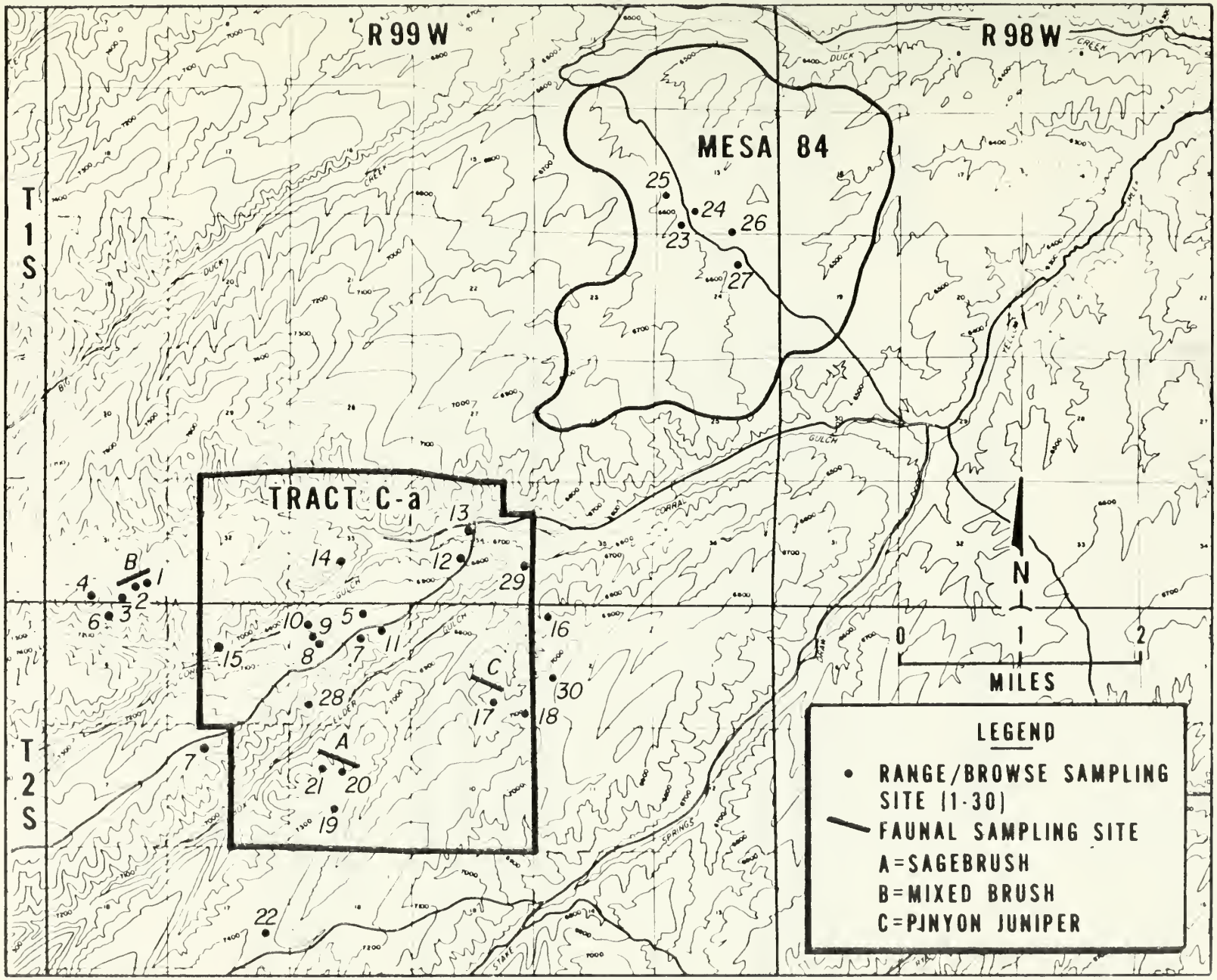

FIGURE 8

SAMPLING SITES OF RANGE/BROWSE AND FAUNAL INTERIM MONITORING STUDIES

After data collection, dry-weight production (kg/ha and lbs/A), percent utilization and utilized forage production (kg/ha and lbs/A) will be estimated for each of the three vegetation types. Forage productivity and utilization of the interim and baseline periods will be compared for each vegetation type. The results of the range study will be presented in the second semi-annual report.

CHAPTER 2 - BROWSE CONDITION AND UTILIZATION

2.1 OBJECTIVES

Browse condition and utilization studies are being conducted to determine the condition of important browse plant species and the degree to which wildlife is currently using these plant species. These studies will indicate the current carrying capacity of the wildlife habitat on and in the immediate vicinity of Tract C-a.

2.2 METHODS

Browse condition and utilization studies are being conducted within three principal vegetation types on Tract C-a and the 84 Mesa study area: pinyon-juniper, sagebrush, and mixed brush. Thirty permanent sampling sites were established within these major vegetation types (pinyon-juniper - 10; sagebrush - 15; and mixed brush - 5) (Figure 8).

Browse plots were established and examined (Cole 1963) in December of 1976. The browse plots will be visited again in spring (1977) to measure the amount of use by deer during winter and again in the fall (1977) to measure use by domestic cattle.

At each sampling site 25 individual key browse plants were examined. Species examined included juniper (Juniperus osteosperma), pinyon pine (Pinus edulis), antelope bitterbrush (Purshia tridentata), snowberry (Symphoricarpos oreophilus) big sagebrush (Artemisia tridentata), serviceberry (Amelanchier utahensis) and true mountain mahogany (Cerocarpus montanus).

Sampling sites were established by arbitrarily selecting a shurb and permanently marking it. Subsequent shrubs were located along a transect by selecting the closest shrub within a 180^{o} are oriented E-W of the center of the selected shrub.

During field sampling, five parameters were examined and recorded.

Form classes:

1. All available, little or no hedging
2. All available, moderately hedged
3. All available, severely hedged
4. Partially available, little or no hedging
5. Partially available, moderately hedged
6. Partially available, severely hedged
7. Unavailable
8. Dead

Age Classes:

S - seedling - less than 0.3 cm basal diameter
Y - young - 0.3 to 0.6 cm basal diameter
M - mature - over 0.6 cm basal diameter
D - decadent - more than 25% of crown surface is dead

Leader Use Estimates:

Percent of twigs or leaders which are available and show use.

Hedging Classification:

Classification based upon the length and appearance (hedging) of the previous year's growth (the two-year old wood).

1. None to light
2. Moderate
3. Severe

Availability:

Visual estimate of the percent of the plant available to deer as browse, i.e., that portion less than six feet high.

2.3 RESULTS

The data obtained from 30 sampling sites in December of 1976 (Appendix A) are summarized in Table 3 by form class, age class, hedging class, utilization, and availability.

In the mixed brush habitat the most frequently encountered browse species were serviceberry and sagebrush. Mountain mahogany had the greatest percent utilization although all browse species were generally mature and available to herbivores. Most browse species were lightly to moderately browsed, except that 40% of the serviceberry and mountain mahogany were severely browsed (Table 3). Thus, the browse condition of the mixed habitat sampled ranged from poor to good (Cole, 1963) depending on the specific browse species.

In the pinyon-juniper habitat sagebrush was the most common shrub and bitterbrush, mountain mahogany, snowberry and serviceberry (in decreasing order) were less frequent. The sampled browse species were generally mature and available, except for pinyon pine and juniper which had availabilities of 72% and 38% respectively (Table 3) because of their growth form. Utilization was greatest for mountain mahogany, bitterbrush and serviceberry, this corresponds to the high number of severaly hedged individuals of these species. The condition of pinyon-juniper habitat is classified as poor because many of the browse species were severly hadged.

The sagebrush habitat was dominated almost solely by big sagebrush. Shrubs in this vegetation type were generally mature, available, and lightly to moderately hedged; utilization was ten percent or less. The minimum amount of current and past utilization indicates that sagebrush is a less important food source for the herbivores present on Tract C-a than the other two vegetation types.

TABLE 3

CONDITION OF IMPORTANT BROWSE SPECIES SAMPLED IN THREE VEGETATION TYPES DURING DECEMBER, 1976 IN THE VICINITY OF RBOSP OIL SHALE TRACT C-a.

Habitat Type	Species	Number Plants Sampled	Average % Util.	Average % Avail.	Form Class Percentages								Age Class				Hedging Class		
					1	2	3	4	5	6	7	8	Seedling	Young	Mature	Decadent	Light	Moderate	Severe
MB	Serviceberry	49	13	98	28	31	37		2	2				10	84	6	33	30	37
	Sagebrush	40	11	95	43	45	7					5		7	88	5	45	45	10
	Snowberry	22	1	100	32	54	14							14	86		36	50	14
	Mountain Mahogany	10	35	100		60	40								100			60	40
	Pinyon Pine	4		95	25	50		25							100		50	50	
PJ	Pinyon Pine	49	11	72	29	14	12	21	12	2	8	2	12	8	78	2	52	33	15
	Juniper	37	2	38	14	5	5	35	19	3	5	14			78	22	59	31	10
	Sagebrush	108	10	82	20	18	17	7	11	20		7	1	2	55	42	30	31	40
	Snowberry	5		95		20	80								80	20		20	80
	Bitterbrush	33	60	88	9	46	33					12			88	12	3	55	41
	Mountain Mahogany	16	84	100		13	87								100			13	87
	Serviceberry	2	48	100			100								100				100
SB	Sagebrush	360	10	76	27	20	11	5	8	18	<1	11		<1	65	35	33	28	29
	Serviceberry	8	3	88	75	25							25	12	63		87	13	
	Snowberry	5		100	20	60	20								100		20	60	20
	Pinyon pine	2		100	50	50									100		50	50	

MB = Mixed Brush
PJ = Pinyon-juniper
SB = Sagebrush

The results discussed above are generally comparable to those reported by Ecology Consultants, Inc. (ECI) (Progress Report 10, 1977) although ECI did not sample browse conditions in the sagebrush habitat. Utilization estimates are generally similar but the degree of hedging reported by NUS is greater. One must be cautious in comparing interim monitoring and baseline results because sample size differed. Baseline studies included 100 sampling sites for mixed brush and pinyon-juniper as compared to fifteen for these habitats during interim studies.

CHAPTER 3- MULE DEER

3.1 OBJECTIVES

Two years of baseline data on the relative abundance and distribution of mule deer in the Tract C-a study area have already been collected. The methods employed included aerial censuses and pellet group counts. The primary purpose of this interim study is to collect additional information on mule deer in the study area.

3.2 METHODS

Tract C-a was visited in December of 1976 to establish deer pellet group transects for interim environmental monitoring. These transects were established in the sagebrush, mixed brush and pinyon-juniper vegetation types. Approximate locations of the transects are shown in Figure 8 .

Since no deer pellet plot transects were established on 84 Mesa during the baseline studies, all pellet group transects for the interim monitoring were established on Tract C-a. Each transect includes 25 circular plots of 1.13 m radius (4 m^2) each (modified from Batcheler, 1975). Sample points were established every 20m along the transect and a search was made up to 6 m around each point to locate the center of the nearest pellet group. If a pellet group was not found, the transect point was considered the plot center. Slope, aspect and phytosociology of the area were noted for each

plot location.

All transect points and all plots were marked with 1 cm steel rebar stakes. The transect points were marked with waterproof ink on durable tags according to vegetation type (S for sagebrush, MB for mixed brush and PJ for pinyon-juniper) and sequentially numbered from 1 to 25 in each vegetation type. The identification tags were attached to the stake on the side toward the pellet group plot to facilitate future plot location. All transect points were marked with fluorescent pink flags. Pellet groups were sprayed with orange enamel paint and a similarly painted rock was placed in each group.

The pellet plots will be inspected in May and August of 1977. New pellet groups and status of old groups will be recorded.

After each data collection period, estimates of deer density in each vegetation type will be calculated, on the basis of pellet group counts. Density data will be compared with the browse utilization data and with the mule deer pellet group and aerial survey data from the baseline studies. In addition to comparisons with other data, variations in pellet group densities of the three vegetation types will be described. Raw data and analyses will be presented in the second semi-annual report.

3.3 RESULTS

Light snow (1.5 to 2 cm) snow was present in patches on N, N-NW and N-NE facing slopes. The snow slightly hampered the search for pellet groups. However, pellet groups were abundant and only three transect points out of the 75 established had no pellet groups (six or more pellets) within a 6 m radius. The majority of the marked pellet groups were judged to be more than one year old. However, deer were using the Tract during the visit and seven pellet groups found on the plots were thought to have been deposited in the fall of 1976.

No special problems were encountered in conducting this task. Because of the snow cover, some plots may not have been situated at the pellet group nearest the transect point but this should not cause any difficulty in late sampling. The time of year of plot establishment (later than optimum) may present some problems when results of the interim monitoring are compared with the baseline data.

CHAPTER 4 - SMALL MAMMAL STUDIES

4.1 OBJECTIVES

RBOSP conducted extensive small mammal studies during the two year baseline program and collected data on species presence and distribution, community composition, food and reproductive effort. A limited small mammal live trapping program will be conducted during the interim monitoring program. The objectives of this program will be to attempt to detect changes from established baseline data for Tract C-a small mammal populations.

4.2 METHODS

Small mammals will be trapped once (late spring of 1977) during the interim monitoring period in the same general location as the mule deer pellet transects (Figure 8). Live trap lines will consist of two parallel lines 15 m apart and will have 20 trapping stations per line at 15 m intervals. Three Sherman live traps (9.5 x 9 x 23 cm) will be placed at each station. Traps will be baited with a mixture of peanut butter and birdseed. Cotten will be provided as a nesting material and all traps will be covered to prevent death of captured animals from exposure.

All trap stations will be prebaited at least 24 hours prior to the initiation of trapping. All traps will be set and checked in the morning and evening. Trapping will be conducted for three consecutive 24-hour periods. If on the third day, captures of new individuals of predominant species (deer mouse, pinyon mouse, least chipmunk, Colorado chipmunk, golden-mantled ground squirrel,

thirteen-lined ground squirrel) equal or exceed 50% of total captures for that day, the Scope-of-work will be amended with RBOSP approval to extend trapping until the number of new captures falls below 50% of total captures for the day (not to exceed three additional days of trapping). All animals captured will be marked (if previously unmarked) with a unique toe clip combination and released. Data recorded for each individual animal captured will include species, sex, toe clip number, reproductive status and trap location. Three sets of trap lines will be established during interim monitoring, one in each of the three major vegetation types (i.e., sagebrush, pinyon-juniper and mixed brush) on Tract C-a.

Raw data on small mammal captures, including new captures and recaptures, will be presented in the second semi-annual report. Indices of abundance will be calculated. Comparisons of species composition and numbers captured will be made amoung vegetation types and between the interim and baseline data.

CHAPTER 5 - AVIFAUNA STUDIES

5.1 OBJECTIVES

Previous RBOSP avifauna investigations on Tract C-a have included determination of seasonal variations in songbird population composition, distribution and abundance. Raptor surveys and waterfowl surveys have also been conducted. Avifauna field studies during the interim monitoring period will be conducted for selected species during the breeding season (May-June 1977). The objectives of this census are to estimate breeding bird populations, to determine the breeding bird species composition in three major habitat types and supplement baseline information data on territory size and reproductive effort of important songbirds on Tract C-a.

5.2 METHODS

The breeding bird census will concentrate on important species of the Tract C-a study area including mourning dove, vesper sparrow and Brewer's sparrow.

The three major vegetation types on Tract C-a sagebrush, pinyon-juniper and mixed brush vegetation will be censused. A 12 ha study plot (400 m by 300 m) will be established in each vegetation type near the mule deer pellet transects (Figure 8) and divided into 1 ha units. Each corner of the 1 ha units will be marked to facilitate subsequent mapping efforts and will follow procedures outlined by Hall (1964) and Robbins (1970). A qualified observer will complete at least three censuses of each individual 1 ha plot and will record species encountered, location of the observation, nest location, nest contents and reproductive status of avifauna observed. Since environmental factors such as wind speed, precipitation, cloud cover, etc., can affect the behavior of avifauna, observations will be made only under suitable conditions. After field work is completed, a composite map showing locations of the territories and nests of species encountered will be drawn. Analyses of these maps will provide an indication of species densities, relative territory size and reproductive effort for each 12 ha plot.

Raw data and estimates of breeding bird densities will be presented in the second semi-annual report. Because the census technique is a mapping technique, the data will not be computer-compatible with existing baseline data which was collected using the Emlen (1971) strip census method. However, major population changes of important species should be identifiable. Comparisons of species composition and estimated number of birds within each vegetation type, among vegetation types, and between interim and baseline data will be made.

CHAPTER 6 - THREATENED AND ENDANGERED SPECIES

6.1 OBJECTIVES

During the baseline data accumulation program, the greater sandhill crane (a state endangered species if breeding in the state) and the whooping crane (a federal endangered species) were observed in the vicinity of tract C-a. In addition, a peregrine falcon (federally endangered) was observed in the vicinity of Tract C-a. The interim monitoring program is designed to provide additional information on the use of Tract C-a, 84 Mesa and adjacent areas

by threatened or endangered species and to establish their current status in the area. The following program has been developed for greater sandhill cranes. If additional threatened or endangered species are sighted, studies will be developed (with the approval of RBOSP) to monitor these species.

6.2 METHODS

Ground surveys on foot and vehicle will be initiated in the spring (1977). The surveys will begin at the onset and cease at the end of the greater sandhill crane migration period as determined from contact with state and federal wildlife authorities. An effort will be made to coordinate studies with the BLM, CDOW and US Fish and Wildlife Service to maximize effectiveness of the coverage.

If greater sandhill cranes are sighted, the observer will record species, number, age class (if determinable), location, time of day and weather conditions (the present day, the previous night and any known forecast). While observing the birds, any change in weather conditions will be recorded. The observer will remain with the birds (at an appropriate observation distance) until they leave the area or until dark. During this period, the observer will record significant behavioral patterns (e.g., feeding, resting, displaying). As soon as birds leave the area, the observer will report to RBOSP who will contact responsible agencies such as CDOW and U.S. Fish and Wildlife Service.

Ground surveys will be conducted by NUS (when possible, assisted by one or more of the agencies) for three weeks in the spring (1977). Areas to be surveyed include Tract C-a, 84 Mesa, Stake Springs Pond, Stake Springs Draw and Yellow and Duck Creeks. Appropriate agencies have been contacted and a joint site visit with BLM is scheduled for early April.

If additional threatened or endangered wildlife species are sighted by terrestrial ecologists on the tract, RBOSP will be informed as soon as practicable.

If additional threatened or endangered wildlife species are sighted by terrestrial ecologists on the tract, RBOSP will be informed as soon as practicable.

The second semi-annual report will present data obtained during the spring migration period and conclusions regarding the status of cranes in the area. Important deviations from baseline observations will be identified and discussed.

LITERATURE CITED

Batcheler, C. L. 1975. Development of a distance method for deer census from pellet groups. J. Wildl. Manage. 39(4):641-652.

Cole, G. F. 1963. Range survey guide. United States Dept. of the Interior National Park Service, Washington, D. C.

Emlen, J. T. 1971. Population densities of birds derived from transect counts. Auk 88; 323-342.

Hall, G. 1964. Breeding-birds census - why and how. Aud. Field Notes 18:413-416.

RBOSP. 1977. Progress Report - 10. Rio Blanco Oil Shale Project, Denver.

Robbins, C. 1970. Recommendations for an international standard for a mapping method in bird census work. Aud. Field Notes 24(6):723-726.

United States Department of Agriculture, Forest Service. 1970. Range Environmental Analysis Handbook, 2209.21R3. United States Department of Agriculture Forest Service.

SECTION III - HYDROLOGICAL STUDIES

Extensive hydrology data have been collected from Tract C-a during the baseline monitoring program. The hydrology program includes studies of precipitation, surface water and groundwater. The United States Geological Survey (USGS) operates 11 gaging stations in the vicinity of Tract C-a. These stations continuously and automatically monitor stream temperature, conductivity, flow and sediment load during the spring, summer and fall. During the winter three stations are operated. The USGS also conducts extensive monthly water sampling and analysis programs at each of these stations during periods of stream flow.

Precipitation data are collected at six stations in the vicinity of Tract C-a. Three of these stations are associated with surface gaging stations and supply cumulative precipitation data. The other three stations monitor storm or short-term precipitation events as well as cumulative precipitation. Precipitation samples for chemical analysis are presently being collected on Tract C-a.

Fifteen alluvial aquifer monitoring holes have been completed in the area. Seven failed to produce water during drilling and have not contained water during the baseline program. Eight holes have continuously had measureable water levels since drilling. Water levels, pH, temperature and conductivity are determined in the field monthly at each of these eight stations. Extensive water quality analyses are also preformed on these monthly samples. Generally, water samples collected from Tract C-a indicate that concentrations of most of the constituents monitored are below U.S. Public Health Service (USPHS) recommendations for potable water. On the other hand, concentrations of some constituents in Yellow Creek samples, including fluoride, iron, manganese, sulfate and dissolved solids, exceed USPHS recommended limits.

During various pre-lease exploration programs, two deep groundwater aquifers were identified and some of their relative characteristics identified. RBOSP has gathered additional data from their drilling, monitoring and pumping test programs. The results of all these programs have shown the upper aquifer to be

located near the base of the Parachute Creek member of the Green River Formation. Water quality of the upper aquifer was generally found to be better than that of the lower aquifer. Water level was continuously monitored in a number of wells in each aquifer.

Wright Water Engineers (WWE) has been the hydrologic consultant for RBOSP and as such has collected the groundwater data and has reported all hydrologic data. Data have been presented in Quarterly Reports 1 through 10, The Open Pit DDP and the Final Baseline Report.

CHAPTER 1 - SURFACE WATER

1.1 OBJECTIVES

The objectives of these studies are to provide basic information on stream conditions during the interim period and to compare interim suspension data to established baseline data.

1.2 METHODS

The Tract C-a surface water monitoring program during the suspension period consists of two major components: 1) the continuation of the continuous and automatic monitoring of the surface water; 2) the semi-annual monitoring of a limited number of physical and chemical constituents of these waters.

During the suspension period, after completion of the second year of baseline data, the USGS continued to monitor the 11 surface water gaging stations, (shown on Figure 1 and listed in Table 4) which were set up during the baseline program. However, the program included only continuous or automatic measurement of temperature, conductivity, flow and sediment load.

A modified surface water quality program was initiated. Parameters monitored during this program are indicated in Table 5. These water quality parameters were monitored semi-anually at several stations (Figure 1) within the confines of the present study area. The stations are:

TABLE 4

LOCATION AND USGS IDENTIFICATION NUMBERS
FOR STREAM AND RAIN GAGING STATIONS

USGS Identification Number	LOCATION
09306237	Dry Fork near west line Tract C-a
09306235	Corral Gulch near west line Tract C-a
09306240	Box Elder Gulch near west line Tract C-a
09306242	Corral Gulch east of Tract C-a
09306230	Stake Springs Draw near confluence with Corral Gulch
09306255	Yellow Creek near White River, Colorado
09306241	Rinky Dink Gulch near east line Tract C-a
09306248	Upper Big Duck Creek north of 84 Mesa
09306250	Lower Big Duck Creek north of 84 Mesa
09306246	Tributary to Yellow Creek east of 84 Mesa
09306244	Corral Gulch south of 84 Mesa (near 84 Ranch)
	STORAGE-TYPE RAIN GAGES
09306235	Corral Gulch near west line Tract C-a
09306237	Dry Fork near west line Tract C-a
09306240	Box Elder Gulch near west line Tract C-a
	RAINFALL INTENSITY AND RECORDING RAIN GAGES
09306230	Stake Springs Draw near confluence with Corral Gulch
09306255	Yellow Creek near White River, Colorado
No number	Cathedral Bluffs located in NW¼, NW¼, Sec.14 T2S, R100W

- Corral Gulch - The sampling station is located at the USGS gaging station on Corral Gulch (09306242) just as it leaves Tract C-a. This station corresponds to aquatic baseline sampling station No. 13.
- Yellow Creek - The sampling station is located at the USGS gaging station located on Yellow Creek near the White River (09306255). This station corresponds to baseline sampling station No. 20.
- White River - This sampling station is located in a side channel approximately 30 meters downstream from the confluence of the White River and Yellow Creek. It corresponds to baseline sampling station No. 29.
- Other - If any unusual flow events are observed during the interim monitoring period, efforts will be made to collect samples and notify the USGS, WRD.

Water temperature, conductivity, flow and sediment load are being monitored continuously or automatically at the gaging stations. Physical and chemical water quality parameters are monitored twice a year, once during high flow and once during low flow. Field measurements of pH, dissolved oxygen, conductivity and temperature will be collected during normal field station visits by USGS personnel.

1.3 DISCUSSION AND RESULTS

Data from the in-stream monitors were collected from the Corral Gulch gaging station east of Tract C-a and from the Yellow Creek gaging station near the confluence with the White River. However, at this time, the water samples to be taken during high and low flow periods have not been collected.

To date, continuous flow records have been received from the USGS for three stations: Corral Gulch near the western border of Tract C-a, Corral Gulch east of Tract C-a, and Yellow Creek. The results of these date are plotted on Figures 9 through 11. The other four surface water gaging stations had no reported flow.

TABLE 5

PHYSICAL AND CHEMICAL WATER QUALITY PARAMETERS*

To be monitored on a semi-annual basis
during the suspension period

Temperature	Dissolved Oxygen
Conductivity	Fluoride
Total Dissolved Solids	Magnesium
Carbonate	Nitrate plus Nitrite (reported at N)
Boron	Total Phosphate
Bicarbonate	Potassium
Calcium	Silicon Dioxide
Chloride	Sulfate
Dissolved Organic Carbon Fractionation	Sodium
	Arsenic**
	Copper**
	Chormium**
	Cadmium**
	Mercury**
	Lead**
	Selenium**

* See "Techniques of Water Resources Investigations of the United States Geological Survey, Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gases"

** Analysis by atomic absorption

Continuous conductivity data have been reported for two of the stations which had flows during the first half of the interim monitoring year. These stations are Corral Gulch near the west border of Tract C-a and Corral Gulch east of Tract C-a. The results of the data, plotted as continuous mean conductivities, are given on Figures 12 and 13.

Continuous temperature data were collected from the three gaging stations which recorded flow. However, the Corral Gulch stations are the only ones for which these data have been reported by the USGS. Continuous temperature data, shown as mean temperatures, are given on Figures 14 and 15. Sediment concentrations are shown on Figure 16.

CHAPTER 2 - ALLUVIAL GROUNDWATER AQUIFERS

2.1 OBJECTIVES

The objectives of these studies are to monitor static water levels and limited physical parameters of the alluvial groundwater and to compare these data with baseline data.

2.2 METHODS

Temperature, specific conductance and static water level of all eight water-bearing alluvial monitoring holes are being monitored by WWE on a semi-annual basis during the interim montoring program. Techniques used to monitor these parameters are identical to those utilized during the baseline monitoring program. In addition, water level is continuously recorded at the G-S S11 hole by a Stevens type F, Model 68 recorder.

If the conductivity and/or temperature are less than 80 percent of the minimum value or more than 120 percent of the maximum value recorded for that alluvial hole during the same season during the baseline period, a sample will be collected and analyzed for the baseline parameters.

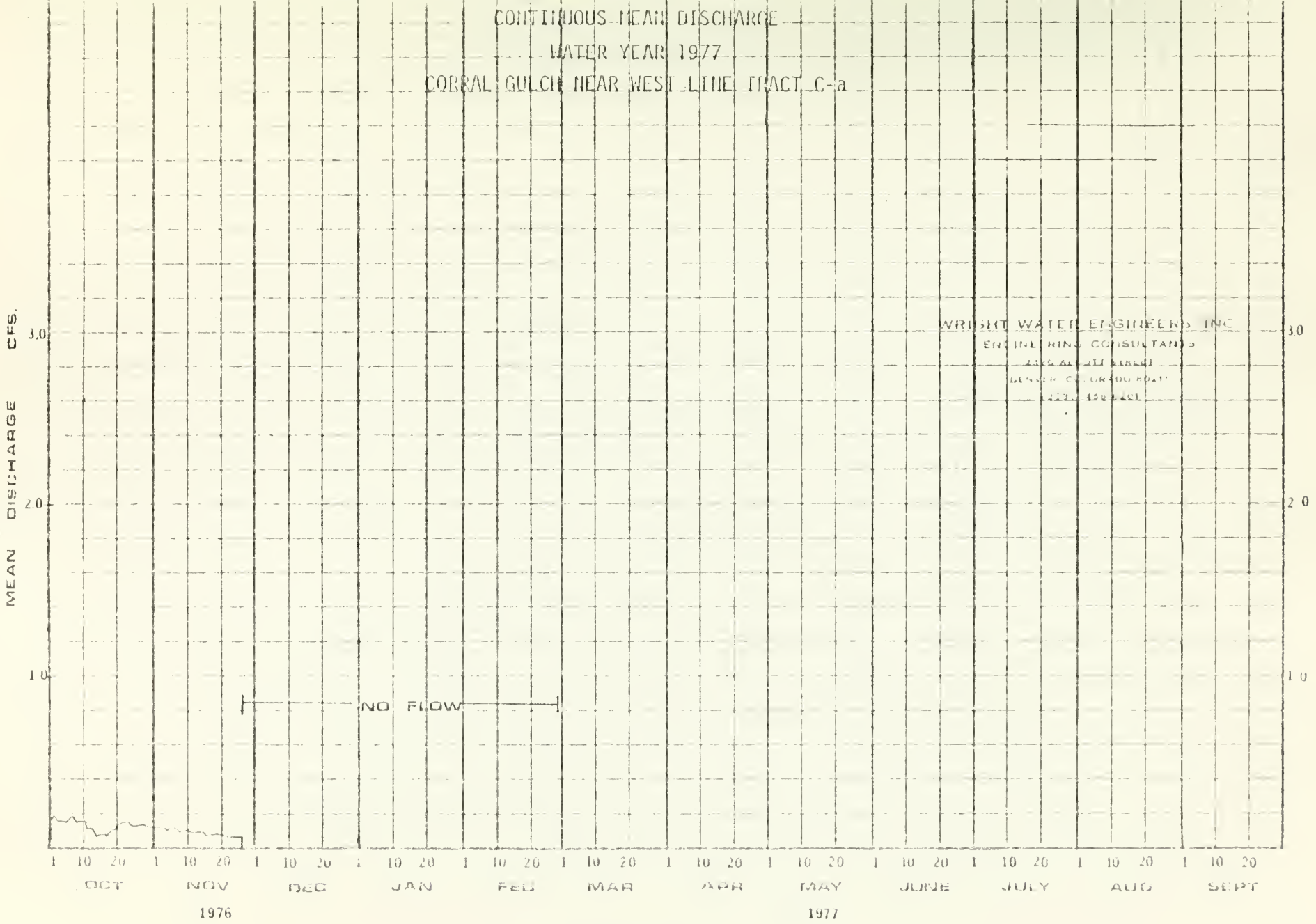

FIGURE 9

CONTINUOUS MEAN DISCHARGE, CORRAL GULCH (WEST LINE), RBOSP

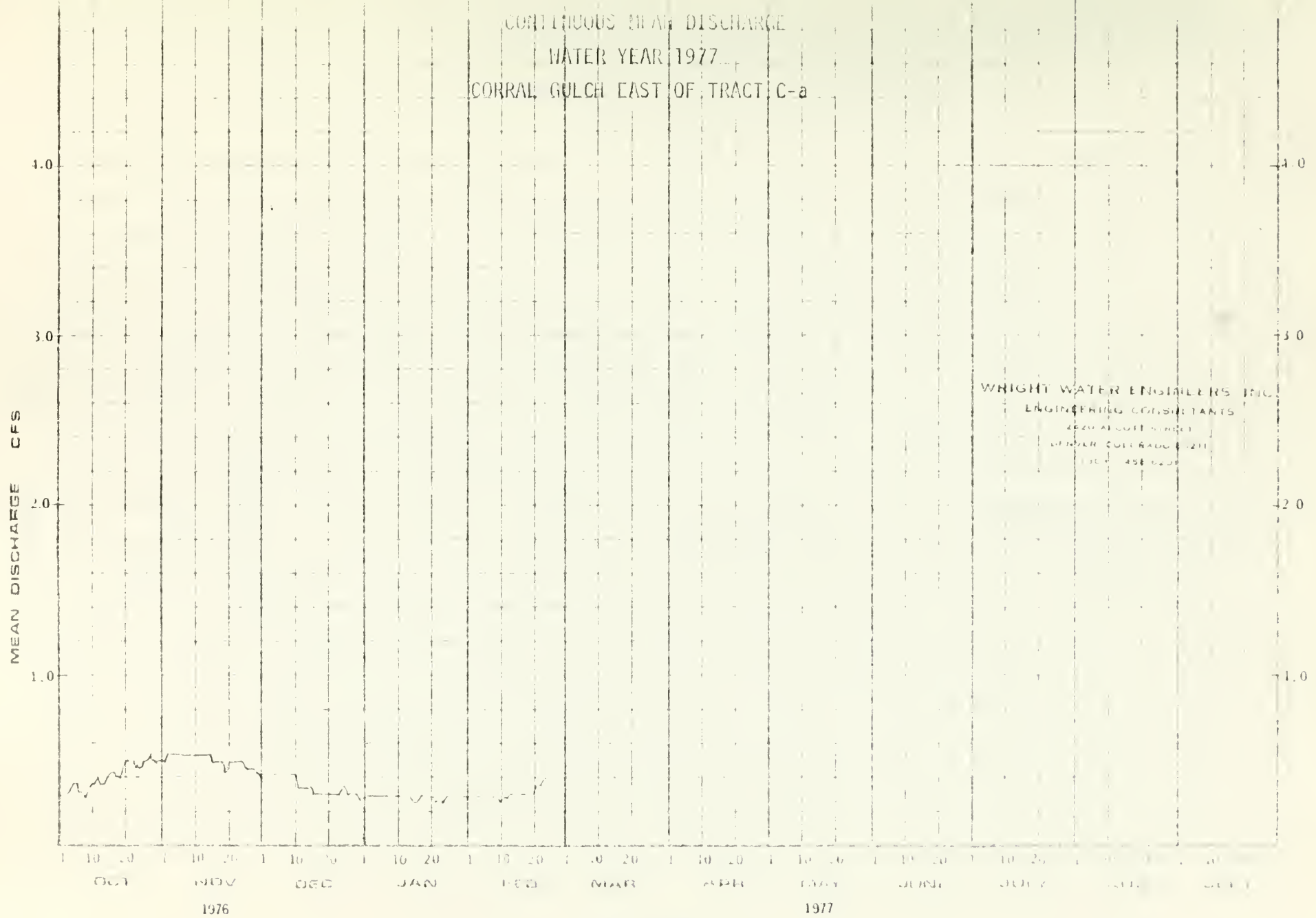

FIGURE 10

CONTINUOUS MEAN DISCHARGE, CORRAL GULCH (EAST LINE), RBOSP

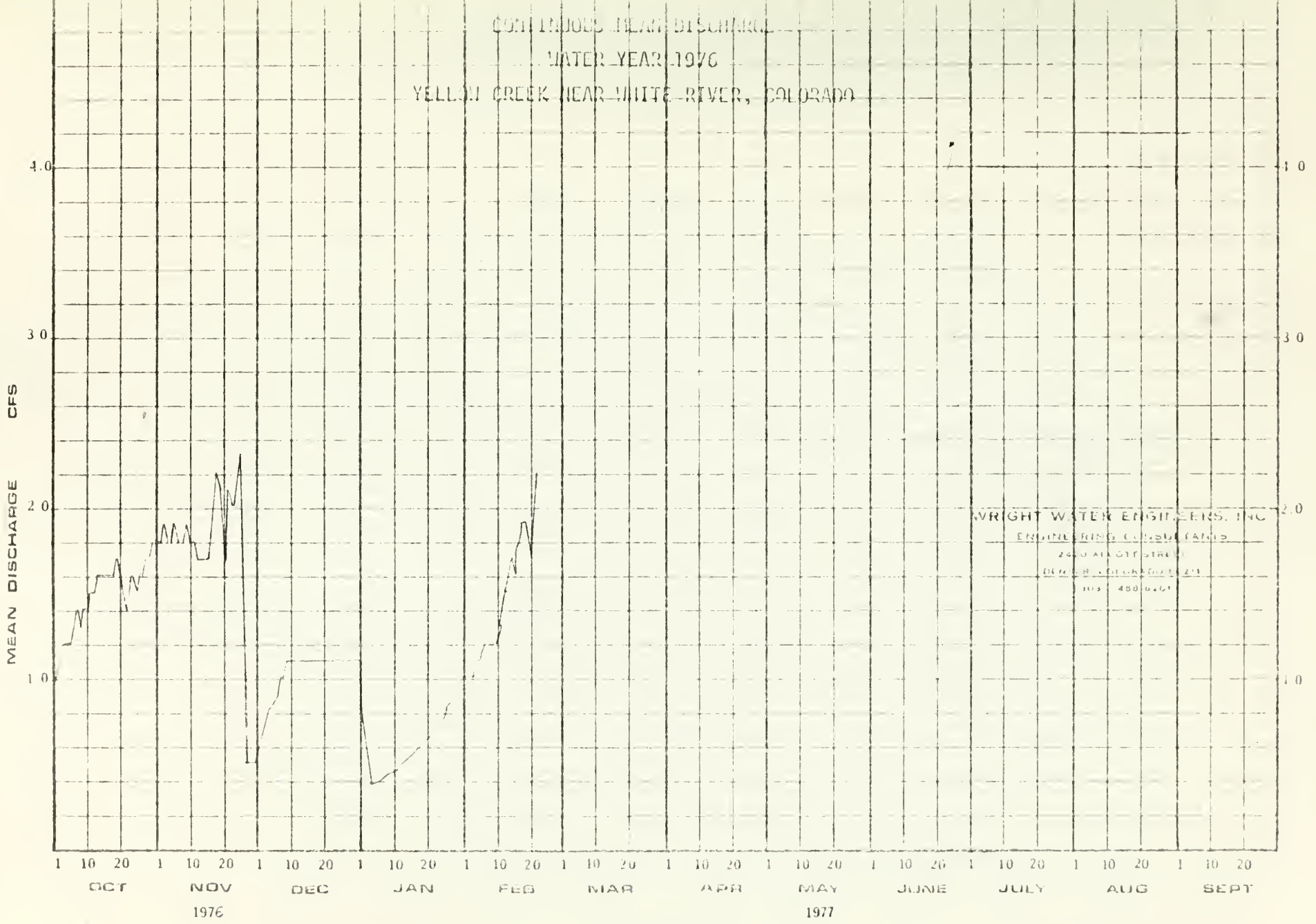

FIGURE 11

CONTINUOUS MEAN DISCHARGE, YELLOW CREEK (NEAR WHITE RIVER), RBOSP

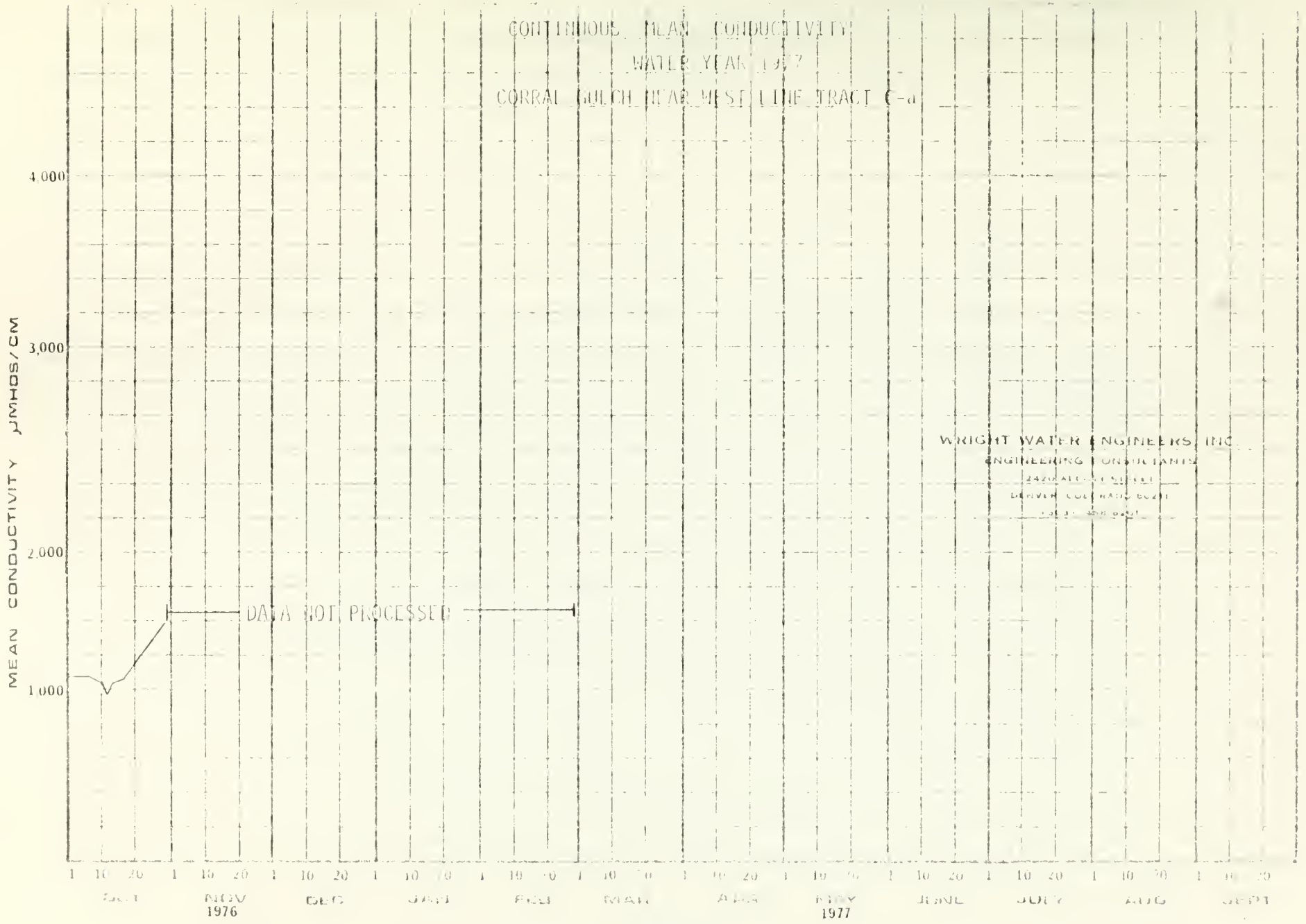

FIGURE 12

CONTINUOUS MEAN CONDUCTIVITY, CORRAL GULCH (WEST LINE), RBSOP

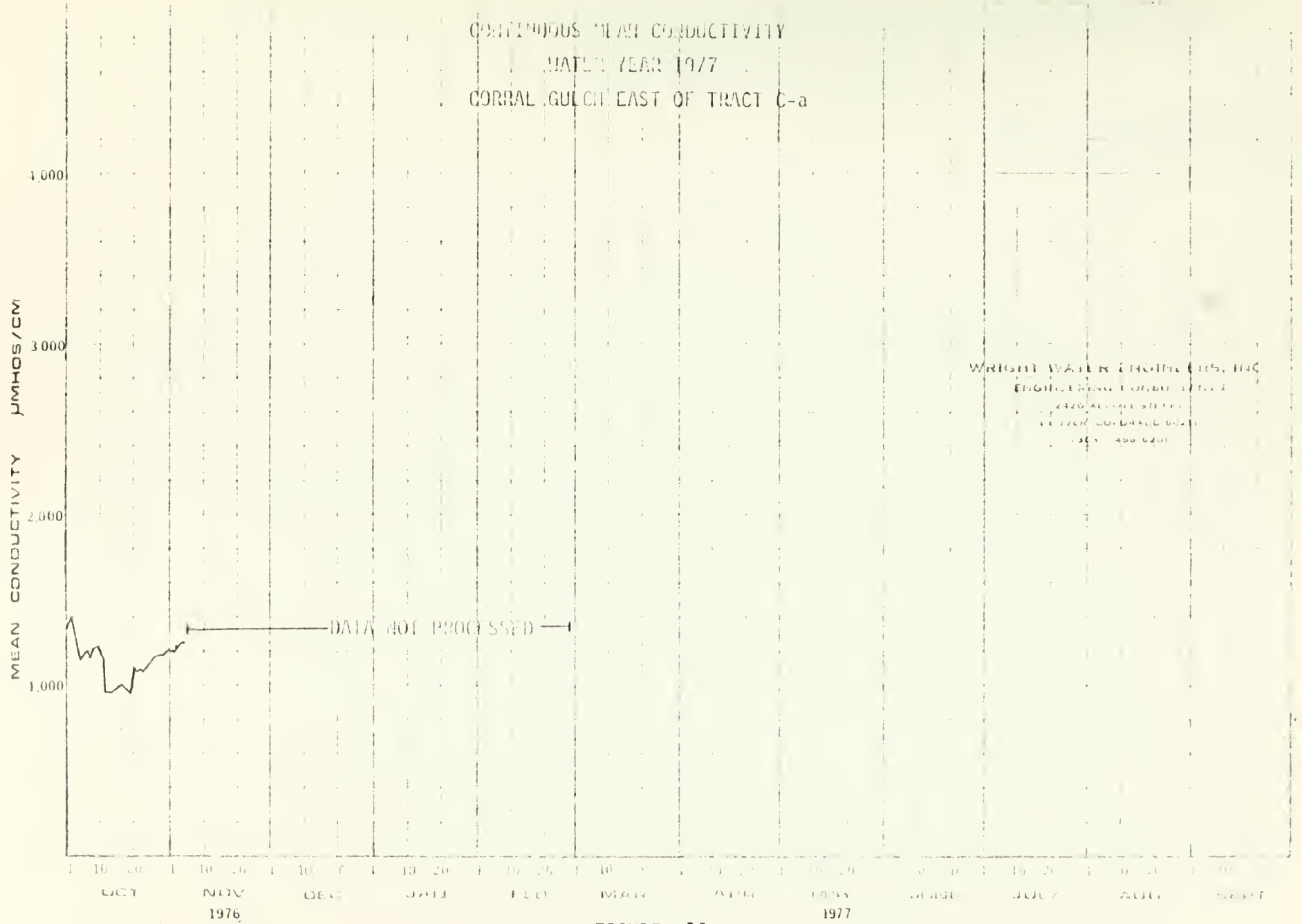

FIGURE 13

CONTINUOUS MEAN CONDUCTIVITY, CORRAL GULCH (EAST LINE), RBOSP

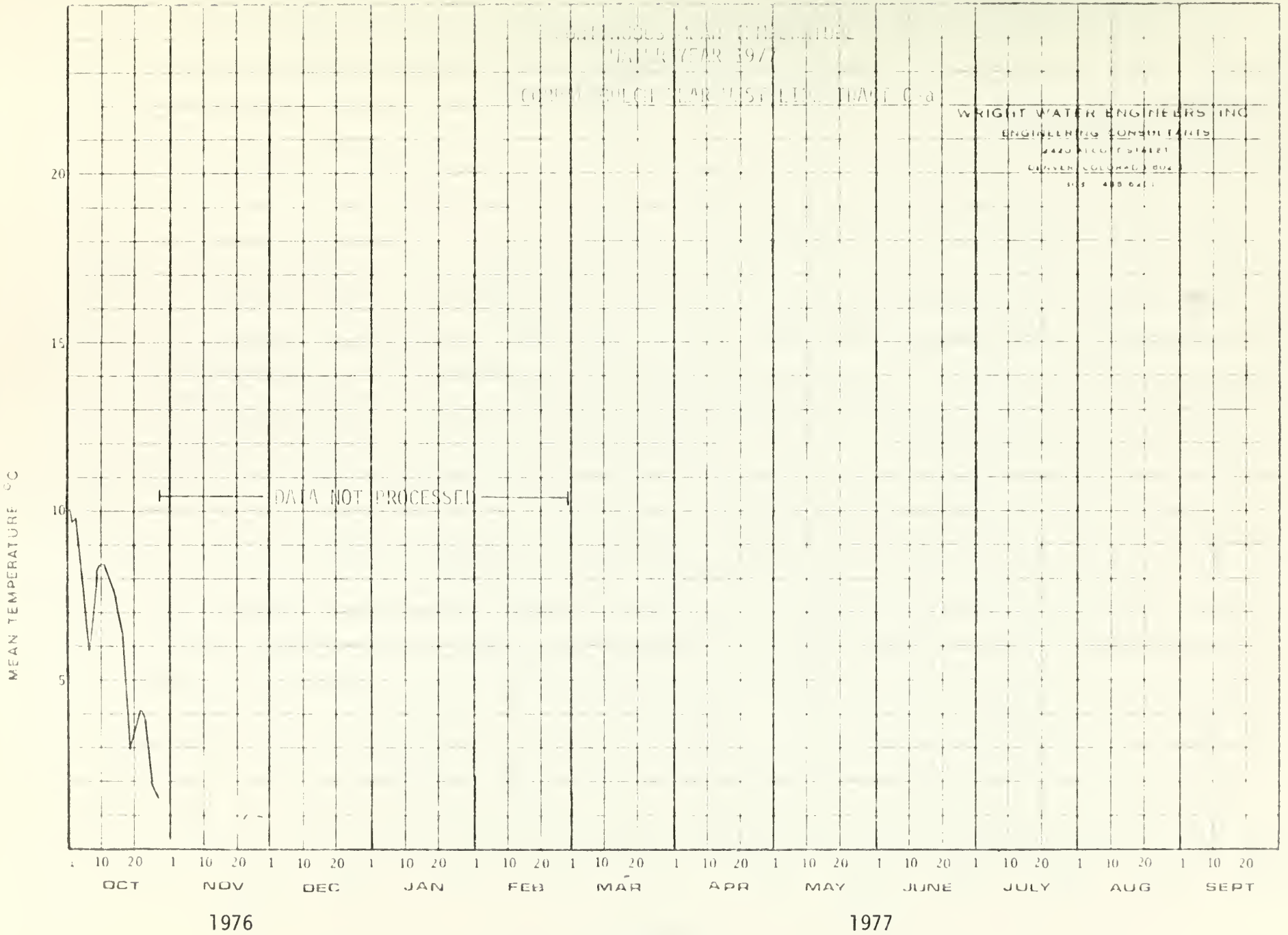

FIGURE 14

CONTINUOUS MEAN TEMPERATURE, CORRAL GULCH (WEST LINE), RBOSP

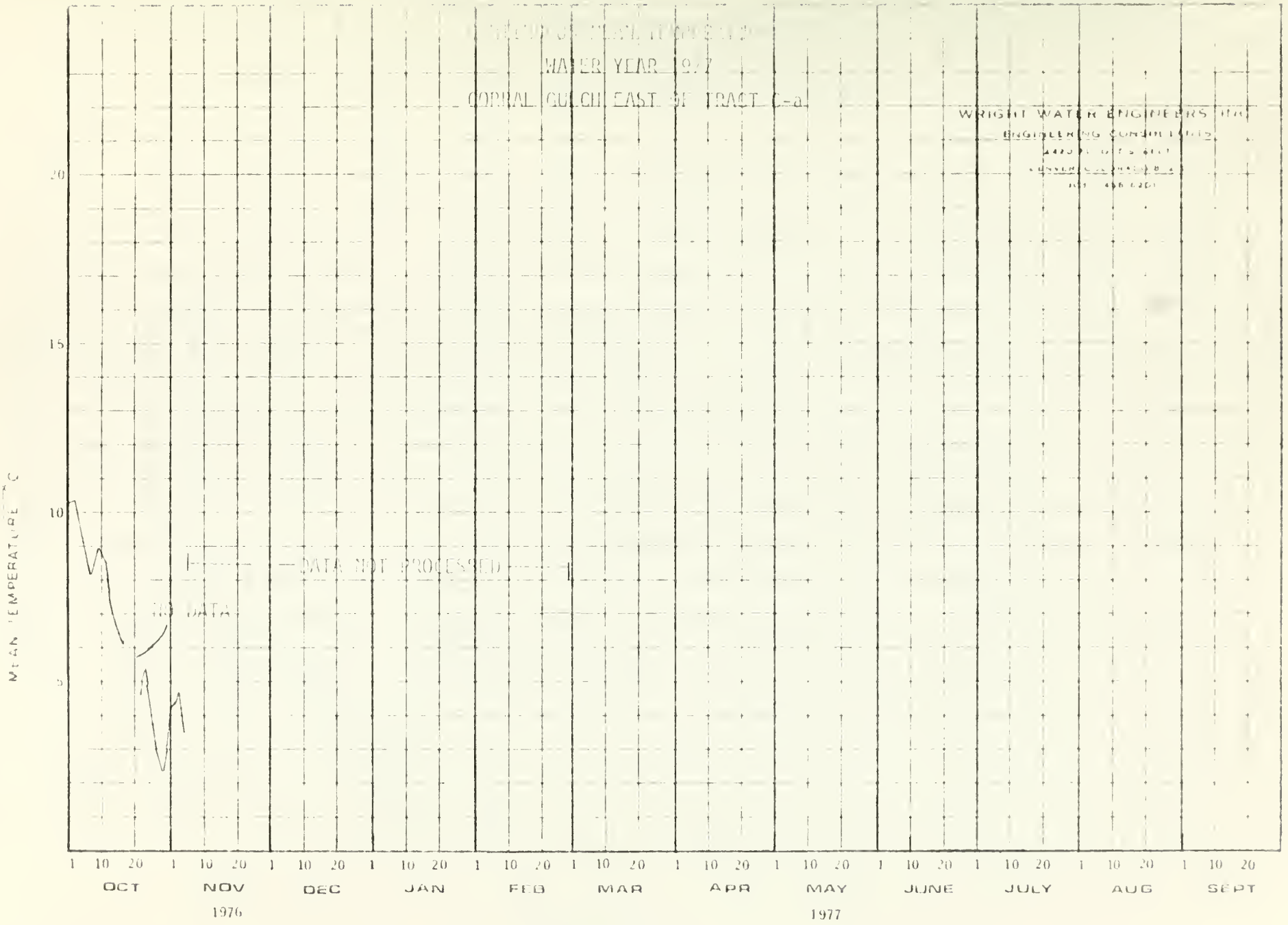

FIGURE 15

CONTINUOUS MEAN TEMPERATURE, CORRAL GULCH (EAST LINE), RBOSP

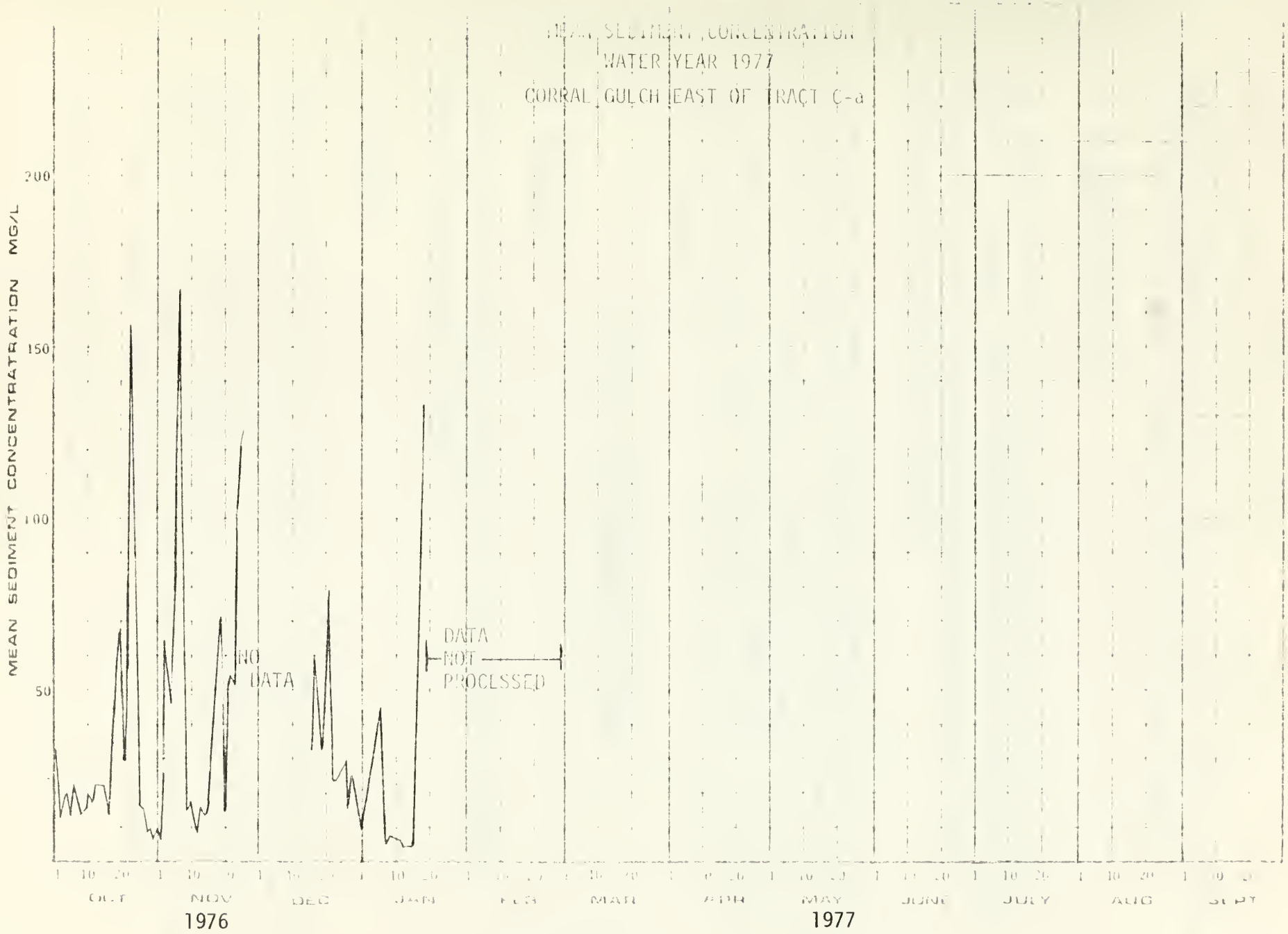

FIGURE 16

MEAN SEDIMENT CONCENTRATION, CORRAL GULCH (EAST LINE), RBOSP

Conductivity, temperature and static water level at the alluvial aquifers will be monitored twice a year, concurrent with the surface water sampling.

2.3 DISCUSSION AND RESULTS

The results of the alluvial water level monitoring of G-S S11 are shown on Figure 17. The water levels recorded during 1977 follow the general trends of those during the two year baseline period and are within the limits established during the previous two years.

The semi-annual measurement of conductivity, temperature and static water levels of the remaining alluvial holes in the vicinity of Tract C-a has not been made as of this time. The data are to be collected approximately concurrently with the surface water data collection during high stream flows. It is anticipated that these high flows will occur in April 1977 and that the low flows will occur in September 1977.

CHAPTER 3 - DEEP GROUNDWATER AQUIFERS

3.1 OBJECTIVES

The objective is to monitor the static water level of deep groundwater aquifers in the vicinity of Tract C-a.

3.2 METHODS

Baseline water quality analysis programs at the two deep groundwater aquifers have been discontinued during the suspension period because the baseline data are considered adequate and because of the slow movement of the groundwater. Static water levels are monitored in all deep aquifer holes on a semi-annual (f-ll and spring) basis. In addition, water levels are continuously recorded in both the lower and upper aquifers at well G-S 4-5 by on-site recorders.

The deep aquifer water level is measured by electronic recorders . The

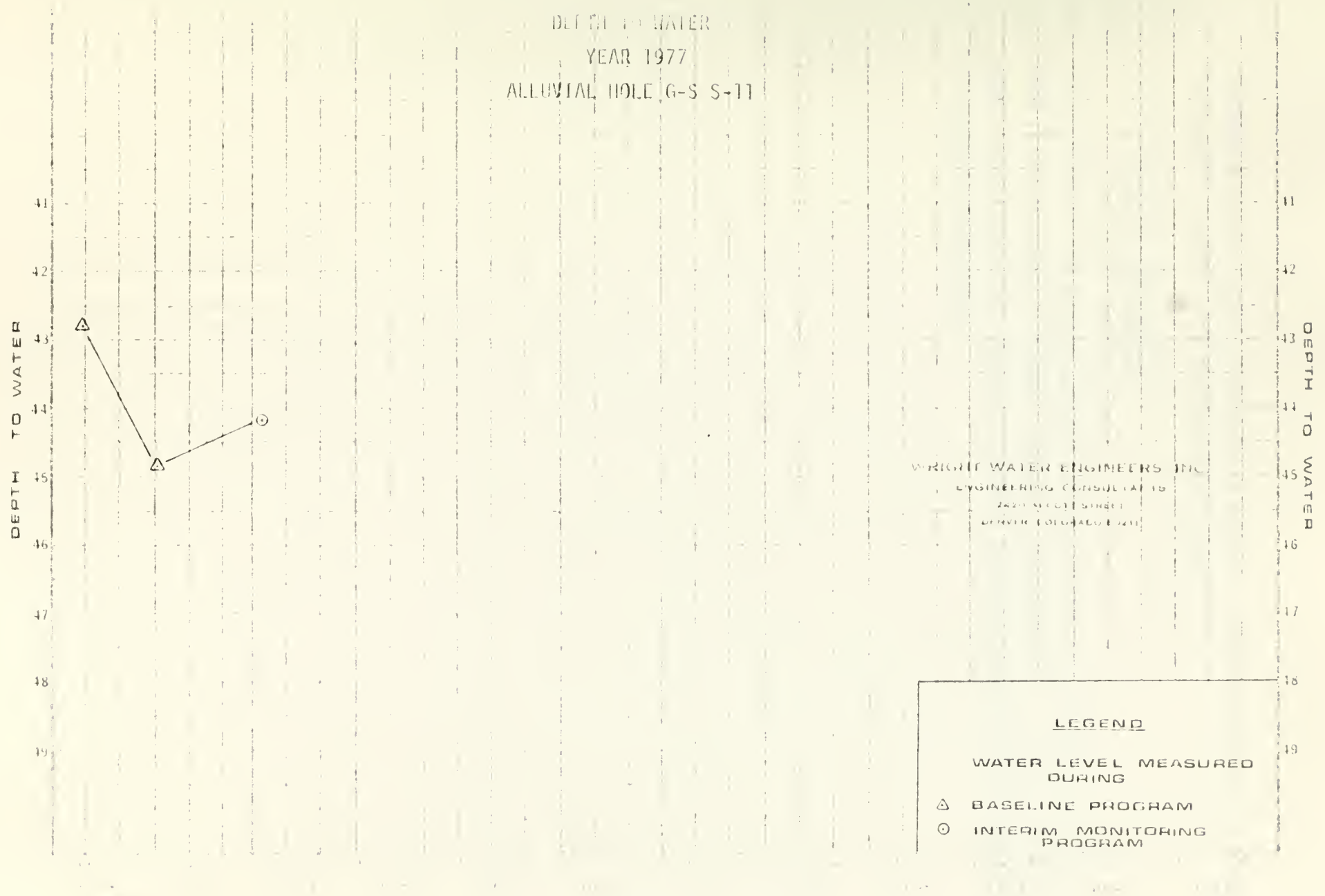

FIGURE 17

DEPTH TO WATER, ALLUVIAL HOLE G-S S-11, RBOSP

recorders are calibrated and serviced monthly. Static water levels in deep groundwater aquifers are monitored semi-annually.

3.3 DISCUSSION AND RESULTS

The results of the continuous monitoring of G-S 4-5 are shown on Figures 18 and 19 for the upper and lower aquifers, respectively. It should be noted that these data points follow the trends set during the baseline period and are highly predictable.

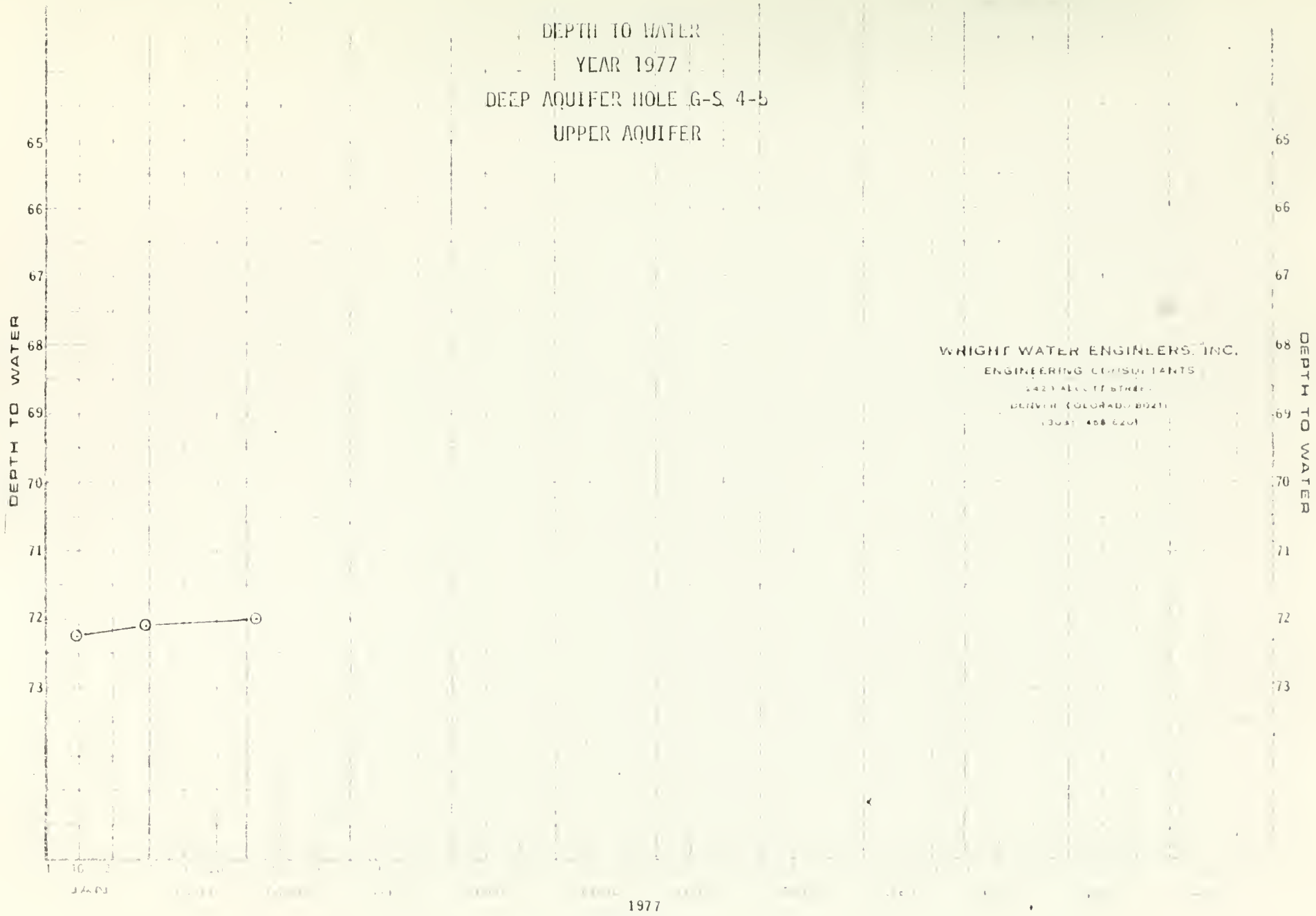

FIGURE 18

DEPTH TO WATER, DEEP AQUIFER HOLE G-S 4-5 (UPPER AQUIFER), RBOSP (ft)

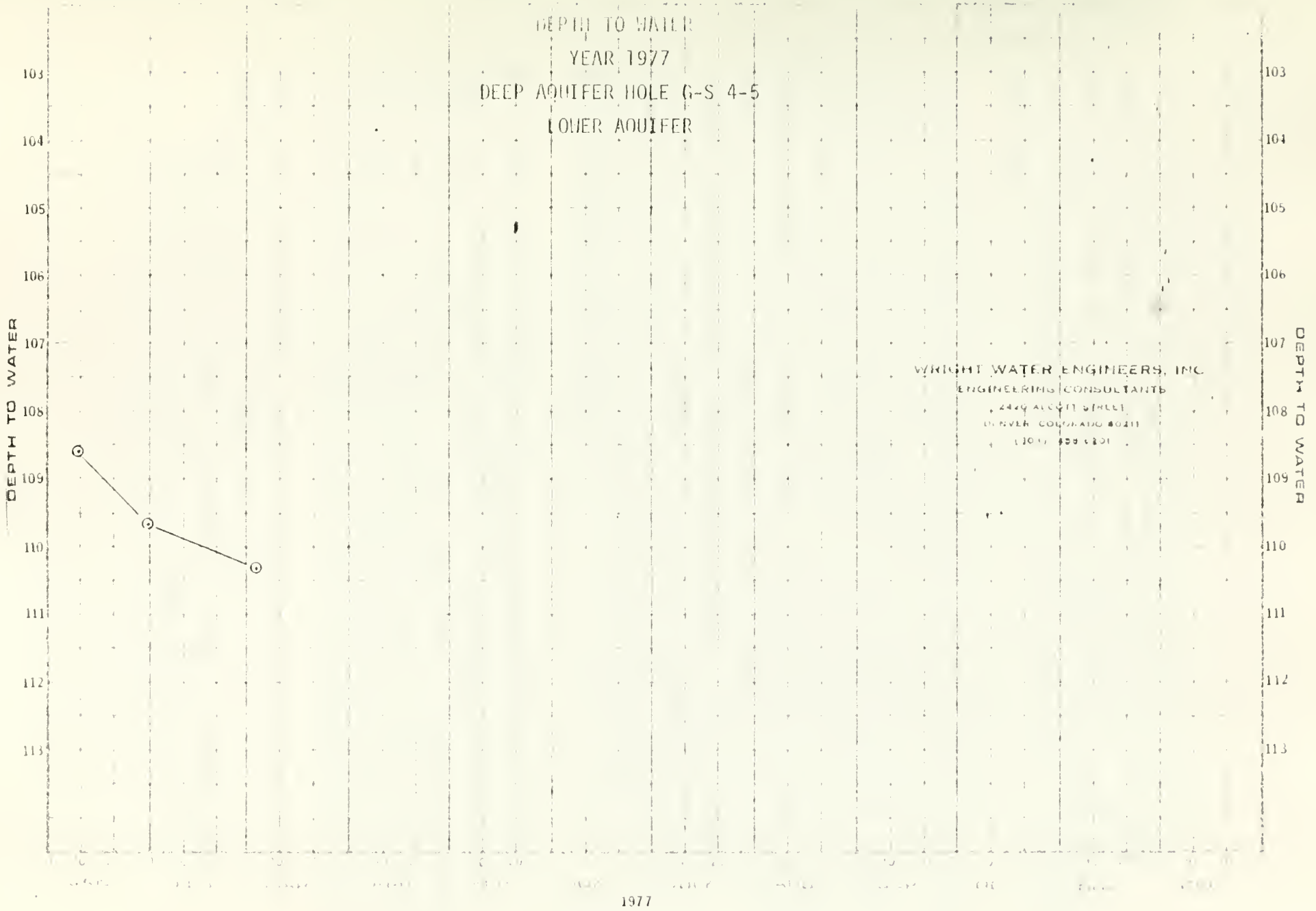

FIGURE 19

DEPTH TO WATER, DEEP AQUIFER HOLE G-S 4-5 (LOWER AQUIFER), RBOSP

SECTION IV - AQUATIC STUDIES

A limited variety of aquatic habitats occur on or near Tract C-a. These habitats include small, marshy ponds and small spring-brooks. Several miles north of Tract C-a are Yellow Creek, a small perennial stream segment, and the large turbulent White River, the only true river habitat in the Piceance Creek Basin.

Extensive data have been collected during the baseline program on the aquatic biology of Tract C-a and vicinity. In addition, information has been gathered on a number of abiotic components of the aquatic ecosystem, including physical and chemical characteristics of the water, sediment chemistry and physical composition of the sediments. Extensive investigations of local hydrology have also been conducted. Due to the extensiveness of this baseline information, it was not deemed necessary to collect additional data on all of these components during interim monitoring studies. There is, however, a need to monitor important elements of the aquatic ecosystem during the suspension period to identify and characterize any changes which may occur during this time. This is the primary goal of the aquatic biology of the interim monitoring program.

During RBOSP aquatic baseline studies, the low abundance and the species composition of phytoplankton, zooplankton and macrophytes indicated that these groups of organisms were of limited significance in the existing aquatic ecosystems. On the other hand, the periphytic algae and benthic macroinvertebrate communities are important in the aquatic systems on and near Tract C-a, and these communities have been included in the interim aquatic monitoring program.

Three representative aquatic sampling stations have been selected for this interim aquatic monitoring program. They are:

- Corral Gulch - The sampling station is located at the USGS gaging station on Corral Gulch just as it leaves Tract C-a. This station corresponds to aquatic baseline Station Number 13.

- Yellow Creek - The sampling station is located near the USGS gaging station now located on Yellow Creek near the White River. This station corresponds to aquatic baseline sampling Station Number 20.

- White River - This sampling station is located in a side channel approximately 30 m downstream from the confluence of the White River and Yellow Creek. This station corresponds to aquatic baseline sampling Station Number 29.

During the baseline monitoring program, fish were found throughout the year in the White River and occasionally in the extreme lower reaches of Yellow Creek. These stations are located more than 20 miles from Tract C-a. Since substantial information was collected on these fish populations during the baseline program, additional data collection is not a part of the interim monitoring program. Should analyses of water quality or aquatic biota data collected during the interim program indicate a possible change in the aquatic ecosystem of the study area, a fishery monitoring program will be developed and implemented to detail the character and magnitude of the change, if dètectable.

CHAPTER 1 - PERIPHYTON

1.1 OBJECTIVES

The objectives of the periphyton studies during interim monitoring is to provide information on trends or changes in populations of these organisms for comparison with baseline studies.

1.2 METHODS

Duplicate periphyton samples, 50 cm^2 each, are collected from flat rock surfaces at each station utilizing a knife and toothbrush. Samples are collected from a riffle area in the middle of the side channel of the

White River, and in the middle of Yellow Creek and Corral Gulch. Samples are collected once in spring and once in fall and coordinated with water chemistry sample collections, whenever possible.

These samples are analyzed in the laboratory for cell density, species composition and relative abundance. The results are then compared to appropriate data from the baseline program.

The preserved periphyton samples are diluted to a constant volume and an aliquot is removed, centrifuged, and washed with distilled water. The samples are then dehydrated and stained in the centrifuge, using successive spinnings and decantings. The following stains and alcohol are used for the periphyton preparation:

a) Water rinse
b) Acid fuchsin stain (Aqueous)
c) Water rinse
d) 50% isopropanol
e) 90% isopropanol
f) 100% isopropanol
g) 100% isopropanol
h) xylene rinse
i) xylene rinse

A number of drops of the final xylene-periphyton suspension are placed on a microscope slide with Hyrax, heated gently, and covered with an ultra-thin cover-glass. The final mounts are retained in the permanent voucher collection.

Periphyton are counted from one randomly chosen transect at 1000x (oil immersion). All organisms appearing in this field are identified and counted. The whole slide is then surveyed at 100x to identify and enumerate larger rare species. Counts are expressed as cells per unit area; these data will be used to compute relative abundance and species diversity.

1.3 RESULTS

Station 13 may be characterized as an alkaline spring-brook habitat. During the December sampling in each of the three years of study, diatoms have dominated the periphytic algal community at this location. The diatom Achnanthes minutissima has been the most abundant taxon in each of the December samplings. Achnanthes minutissima is an indicator of high oxygen concentrations in alkaline waters (Lowe, 1974); such chemical and physical conditions have also been observed at this site during each of the December sampling periods. Densites of periphytic algae were considerably greater in 1975 than in either of the other years. The reason for this difference does not appear to be directly related to the general physical characteristics (presented in Table 6).observed during each of the sampling periods.

Since station 20 has been frozen during two of the three years of aquatic sampling, no year to year comparisons are possible. In December 1975 the periphytic algal community was dominated by the diatom Achnanthes minutissima and the blue-green algae Lyngbya spp and Calothrix spp. This station is located in Yellow Creek which may be characterized as a slightly brackish (due to the high alkalinity and conductivity) spring-brook. This spring-brook segment also generally carries large quantities of organic matter. The algal taxa of the periphyton in this area of Yellow Creek may be characterized as alkaliphilous.

At station 29, no samples could be collected during December 1976 because of the ice cover. Comparison of the data collected at this site during December 1974 and December 1975 indicates that during both periods, diatoms were the most abundant taxa. However, in 1975 the blue-green algae Lyngbya spp and

TABLE 6

COMPARISION OF PHYSICAL DATA BETWEEN THE BASELINE AND INTERIM PERIOD

	6 December 1976	1 December 1975	9 December 1974
Water Temperature (°C)	6	7	7
Conductivity (μmhos/cm)	1200	1300	4250
Dissolved Oxygen (mg/l)	9.4; 9.3	10.6; 10.5	10.0; 10.1
Total Alkalinity (mg/l)	425; 430	420; 424	417; 408
pH	7.4	7.9	8.0
Bottom Substrate	Gravel,Sand	Gravel,Sand	Gravel,Sand
Width (inches)	42	28	36
Velocity (ft/min)	Side Max.	Max.	Side Mid.Side
	40; 84	60	14; 40; 38
Depth (inches)	3	3	1 1½ 1½

TABLE 7

PERIPHYTON DENSITIES OBSERVED DURING RBOSP INTERIM ENVIRONMENTAL STUDIES, DECEMBER 1976. (Data are expressed as cells/mm^2 except data for filamentous forms are expressed as the number of 50μ units.)*

Taxa	Station 13		
	Replicate A	B	Mean
CHRYSOPHYTA			
Achnanthes minutissima	1,809	3,136	2,473
Achnanthes lanceolata	279	896	588
Amphora sp.	-	42	21
Caloneis bacillum	9	14	12
Cymbella affinis	9	140	75
Cymbella microcephala	72	84	78
Fragilaria vaucheriae	9	126	68
Gomphonema intricatum	216	1,148	682
Meridian circulare	108	308	208
Navicula arvensis	333	350	342
Navicula cryptocephala	558	1,484	1,021
Navicula insociabilis	9	14	12
Navicula minima	9	28	19
Navicula viridula	531	1,260	896
Nitzschia acicularis	-	28	14
Nitzschia capitellata	72	196	134
Nitzschia dissipata	18	14	16
Nitzschia frustulum	27	28	28
Nitzschia linearis	45	140	93
Surirella ovata	9	-	5
CHLOROPHYTA			
Stigeoclonium sp.	-	2	1

*Stations 20 and 29 were frozen at the time of sampling.

TABLE 8.

COMPARISON OF MEAN DENSITIES OF THE DOMINANT ALGAL TAXA IN THE PERIPHYTON DURING INTERIM STUDIES (1976) AND BASELINE STUDIES (1974-1976) (DENSITIES ARE EXPRESSED IN CELLS/mm^2).

	December Sampling		
	1974	1975	1976
	Sta. 13	Sta. 13	Sta. 13
CHRYSOPHYTA			
Achnanthes lanceolata			588
Achnanthes minutissima	11,690	64,993	2,473
Gomphonema intricatum	439	20,985	682
Navicula arvensis		3,060	
Navicula cryptocephala	2,699	25,401	1,021
Navicula pelliculosa		4,624	
Navicula viridula			896
Nitzschia linearis	137		
	Sta. 20	Sta. 20	Sta. 20
CHRYSOPHYTA			
Achnanthes minutissima	Frozen	4,997	Frozen
CYANOPHYTA			
Calothrix spp.		224	
Lyngbya spp.		513	
	Sta. 29	Sta. 29	Sta. 29
CHRYSOPHYTA			
Achnanthes minutissima	3,617		Frozen
Cymbella affinis	873		
Diatoma vulgare		1,519	
Epithemia sorex	1,335		
Navicula cryptocephala		1,405	
Navicula salinarum var. *intermedia*		535	
Navicula tripunctata	1,524		
Nitzschia dissipata	1,058		
CYANOPHYTA			
Calothrix spp.		431	
Lyngbya spp.		453	

Colothrix spp were also quite abundant. Although a shift in the species composition of the most abundant taxa was evident between the two years, the cause of this shift is not clear, but is related to differing physical chemical conditions such as: temperatures were $0^{o}C$ in 1974 and $1^{o}C$ in 1975, the conductivities were 1000µmho in 1974 and 817 µmhos in 1975 and the alkalinities were 358 mg/l in 1974 and 224 mg/l in 1975.

CHAPTER 2- BENTHOS

2.1 OBJECTIVES

Benthos are monitored during interim studies to provide information on community trends for comparison with baseline studies.

2.2 METHODS

Two replicate samples are collected in a riffle area in the center of the side channel of the White River and in the stream center at the Yellow Creek and Corral Gulch study areas. Samples are collected with a modified Surber sampler. Samples are washed through a U.S. Standard Number 30 sieve, preserved with buffered 10% formalin, bottled and sent to the laboratory for analysis of species composition and relative abundance.

Standard methods of sample processing and analysis are used in the laboratory. The benthic samples are first agitated and the organisms rinsed with light-pressure fine spray into 8-inch No. 60 sieves to remove any fine sediments. The samples are then hand-sorted under dissection microscopes at 6X magnification.

Samples are systematically searched, pushing examined portions aside and the benthic organisms are removed with forceps. All organisms removed are stored in plastic capsules and 4-dram vials in 70% ethanol. All plastic capsules and 4-dram vials for a given sample are stored together.

With few exceptions, benthic organisms are identifiable to generic level without special preparation. The standard procedure is to identify the organisms to the lowest taxon possible. Identifications of individuals are usually made under the dissecting microscope or with temporary slides (under water) and a compound microscope.

Chironomidae and Oligochaeta are cleared in xylene and then mounted on

permanent slides in Canada balsam. Only complete oligochaetes with intact anterior portions are used for enumeration.

After identification and enumeration, specimens are stored in 70% ethanol in sample jars, collectively by sample replicate. A special reference or voucher collection is maintained apart from the other specimens.

Only those individuals which were living at the time of collection, as indicated by presence of fleshy tissue, are enumerated for the purpose of estimating populations. Empty mollusc shells, exuvia, reproductive structures, etc., are retained as aids in identification and compilation of qualitative species lists, but are not used for estimates of population densities.

Benthos samples are taken twice a year (once in spring and once in fall) and coordinated with data from the water chemistry samples.

2.3 RESULTS

There was a substantial decrease in benthic densities at Station 13 from December 1974 to December 1975 (Table 11). This reduction was probably due to an increased silt load during 1975. Throughout 1975, increased road use and improvement, with resulting fugitive dust, and pumping of test wells into the surface system added to the normal silt load.

The filter feeding Simuliidae, Cheumatopsyche and Hydropsyche were directly inhibited by the clogging of their feeding mechanisms. The population of the predaceous stonefly Isoperla increased while populations of the common dipteran predators Limnophora aequifrons and L. discreta decreased. The stonefly is very mobile and inhabits interstitial areas whereas the dipterans spend their immature lives buried, with only their anal breathing tubes exposed. When this tube is silted over the organism has a difficult time clearing it, especially if the silt load persists. Isoperla is able to move to avoid the affects of siltation. There was also a significant drop in the number of species from 1974 to 1975.

TABLE 9

MACROINVERTEBRATE TAXA OBSERVED DURING RBOSP INTERIM MONITORING, DECEMBER 1976

- Annelida
  - Oligochaeta
- Arthropoda
  - Insecta
    - Ephemeroptera
      - Baetidae
      - Ephemerellidae
        - *Ephemerella*
    - Plecoptera
      - Holognatha
        - Capniidae
      - Systellognatha
        - Perlodidae
          - *Isoperla*
    - Trichoptera
      - Glossosomatidae
      - Hydroptilidae
        - *Hydroptila*
      - Limnephilidae
    - Diptera
      - Tipulidae
        - *Ormosia*
        - *Dicranota*
        - *Holorusia*
      - Ceratopogonidae
      - Chironomidae
      - Simuliidae
      - Stratiomyidae
        - *Euparyphus*
      - Emphididae
      - Anthomyiidae
        - *Limnophora aequifrons*

TABLE 10

DENSITIES OF BENTHIC MACROINVERTEBRATES OBSERVED DURING RBOSP INTERIM ENVIRONMENTAL STUDIES, DECEMBER 1976. (Expressed in organisms/m^2).*

Taxa	Station 13		
	Replicate A	B	Mean
Oligochaeta	670	308	489
Baetidae	2,317	3,656	2,987
Ephemerella	18		9
Plecoptera	525	1,557	1,041
Capniidae	217	91	154
Isoperla	199	380	290
Glossosomatidae	18	18	18
Hydroptila	36	18	27
Limnephilidae	18	36	27
Ormosia		18	9
Dicranota	54	91	73
Holorusia	36	72	54
Ceratopogonidae	54	18	36
Chironomidae	2,244	2,063	2,154
Simuliidae		18	9
Euparyphus	18		9
Empididae	253	91	172
Limnophora aequifrons	54	91	73

* Stations 20 and 29 were frozen at the time of sampling.

TABLE 11

COMPARISON OF BENTHIC DENSITIES OBSERVED DURING INTERIM STUDIES (1976) AND BASELINE STUDIES (1974-76) (org/m^2)

Taxa	6 December 1976 $\bar{m}$	1 December 1975 $\bar{m}$	9 December 1974 $\bar{m}$
Nematoda	-	12	583
Oligochaeta	489	1671	6825
Baetidae	2987	820	11293
Baetis	-	157	664
Ephemerella	9	-	-
Plecoptera	1041	392	426
Capniidae	154	-	677
Capnia	-	18	257
Isoperla	290	706	132
Optioservus	-	6	-
Glossosomatidae	18	-	-
Cheumatopsyche	-	-	13
Hydropsyche		-	19
Hydroptila	27	-	6
Limnephilidae	27	-	6
Dicranota	73	-	25
Ormosia	9	-	-
Holorusia	54	199	163
Pericoma	-	-	31
Ceratopogonidae	36	18	31
Chironomidae	2154	3614	17985
Simuliidae	9	24	15354
Euparyphus	9	18	25
Empididae	172	12	6
Limnophora aequifrons	73	133	658
L. discreta	-	-	451

The 1976 December interim sampling showed an increase in the number of species, which generally indicates a cleaning of the system. However, the number of the silt-intolerant organisms did not increase, indicating that the silt load is still a limiting factor and that the increased diversity is due to silt-tolerant organisms colonizing an area where previously the competition had been too severe. Two of the invertebrates, Ephemerella and Glossosomatidae, had not been recorded from the Tract area during the baseline study. There is still a decrease in the smaller, less mobile organisms, including the Oligochaeta and Chironomidae, however, the mobile herbivores, the baetid mayflies and the winter stoneflies (Capniidae), increased significantly.

Isoperla decreased in numbers but appears to have been replaced by other predators such as Dicranota and Empididae. This probably represents a change in availability of preferred food items.

Table 6 compares the physical data obtained during the respective samplings. The striking difference is the drop in conductivity (dissolved solids). This drop in dissolved solids was probably not a major factor in the population changes observed because the organisms maintain large populations in other areas with low conductivities.

APPENDIX A

BROWSE RAW DATA

LIST OF ABBREVIATIONS FOR THE PLANT SPECIES SAMPLED
IN THE BROWSE STUDIES

ABBREVIATIONS	SCIENTIFIC NAME
ART TRI	*Artemisia tridentata*
PUR TRI	*Purshia tridentata*
CER MON	*Cercocarpus montanus*
JUN OST	*Juniperus osteosperma*
PIN EDU	*Pinus edulis*
AME UTA	*Amelanchier utahensis*
SYM ORE	*Symphoricarpos oreophilus*

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Mixed Brush Sample Unit #: 1

T 1S R 99W S 31 Date: 12/6/76

Aspect (degrees) N Slope (degrees) Elevation (feet) 7400

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Ame uta	2	M	5	Light	100
2	Art tri	1	M	0	Light	100
3	Ame uta	2	M	5	Light	100
4	Art tri	2	M	25	Moderate	100
5	Ame uta	2	M	50	Moderate	100
6	Art tri	1	M	5	Light	100
7	Ame uta	2	M	0	Moderate	100
8	Ame uta	1	M	2	Light	100
9	Ame uta	1	M	0	Light	100
10	Art tri	1	M	0	Light	100
11	Ame uta	2	M	5	Moderate	100
12	Ame uta	1	M	0	Light	100
13	Ame uta	2	M	2	Moderate	100
14	Ame uta	1	Y	0	Light	100
15	Art tri	1	M	0	None	100
16	Ame uta	1	Y	0	None	100
17	Sym ore	3	M	0	Severe	100
18	Art tri	2	M	0	Moderate	100
19	Art tri	2	M	0	Moderate	100
20	Ame uta	2	M	30	Moderate	100
21	Ame uta	1	M	5	Light	100
22	Art tri	2	M	0	Moderate	100
23	Art tri	2	M	0	Moderate	100
24	Art tri	1	M	2	Light	100
25	Pin edu	1	M	0	None	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Mixed Brush Sample Unit #: 2

T 1S R 99W S 31 Date: 12/6/76

Aspect (degrees) N Slope (degrees) Elevation (feet) 7440

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Ame uta	1	Y	0	None	100
2	Art tri	1	M	2	Light	100
3	Ame uta	3	M	15	Severe	100
4	Sym ore	2	M	0	Moderate	100
5	Ame uta	3	M	15	Severe	100
6	Sym ore	1	M	0	Light	100
7	Ame uta	1	M	5	Light	100
8	Art tri	1	M	0	None	100
9	Sym ore	2	M	0	Moderate	100
10	Ame uta	1	Y	0	Light	100
11	Ame uta	1	Y	0	Light	100
12	Ame uta	3	O	2	Severe	100
13	Sym ore	1	M	0	Light	100
14	Art tri	1	M	1	Light	100
15	Sym ore	2	M	0	Moderate	100
16	Ame uta	3	M	10	Severe	100
17	Sym ore	1	M	0	None	100
18	Ame uta	3	M	10	Severe	100
19	Art tri	2	M	10	Moderate	100
20	Ame uta	1	M	25	Light	100
21	Art tri	1	M	2	Light	100
22	Ame uta	3	M	5	Severe	100
23	Sym ore	2	M	0	Moderate	100
24	Ame uta	3	M	10	Severe	100
25	Art tri	2	M	5	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Mixed Brush Sample Unit #: 3

T 1S R 99W S 31 Date: 12/6/76

Aspect (degrees) N Slope (degrees) 30 Elevation (feet) 7520

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Ame uta	3	M	3	Severe	100
2	Sym ore	2	M	0	Moderate	100
3	Art tri	1	M	0	Light	100
4	Art tri	1	M	0	Light	100
5	Art tri	2	M	2	Moderate	100
6	Sym ore	2	Y	0	Moderate	100
7	Sym ore	2	M	0	Moderate	100
8	Art tri	3	M	39	Severe	100
9	Art tri	1	M	2	Light	100
10	Art tri	1	M	25	Light	100
11	Sym ore	1	M	0	Light	100
12	Ame uta	2	M	1	Moderate	100
13	Sym ore	2	M	0	Moderate	100
14	Art tri	1	M	0	Light	100
15	Art tri	2	M	3	Moderate	100
16	Ame uta	2	M	10	Moderate	100
17	Art tri	2	M	4	Moderate	100
18	Art tri	3	M	15	Severe	100
19	Ame uta	6	D	15	Severe	100
20	Art tri	2	M	15	Moderate	100
21	Art tri	2	Y	50	Moderate	100
22	Ame uta	1	M	10	Light	100
23	Art tri	2	M	2	Moderate	100
24	Ame uta	3	M	30	Severe	100
25	Sym ore	2	M	0	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Mixed Brush Sample Unit #: 4

T 1S R 99W S 31 Date: 12/6/76

Aspect (degrees) N Slope (degrees) 10 Elevation (feet) 7600

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Ame uta	3	M	5	Severe	100
2	Sym ore	1	M	0	Light	100
3	Art tri	3	M	0	Severe	100
4	Sym ore	1	Y	0	Light	100
5	Ame uta	3	M	10	Severe	100
6	Art tri	2	M	2	Moderate	100
7	Pin edu	2	M	0	Moderate	100
8	Art tri	2	M	0	Moderate	100
9	Sym ore	2	M	0	Moderate	100
10	Art tri	2	M	0	Moderate	100
11	Art tri	8	D	-	-	0
12	Art tri	1	Y	0	Light	100
13	Art tri	2	Y	0	Moderate	100
14	Sym ore	2	M	15	Moderate	100
15	Ame uta	2	M	5	Moderate	100
16	Art tri	1	M	0	Light	100
17	Sym ore	2	M	0	Moderate	100
18	Art tri	8	D	-	-	0
19	Ame uta	3	M	5	Severe	100
20	Sym ore	1	M	0	Light	100
21	Art tri	2	M	0	Moderate	100
22	Art tri	1	M	0	Light	100
23	Ame uta	1	M	3	Light	100
24	Ame uta	1	M	2	Light	100
25	Ame uta	2	M	1	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 5

T 2S R 99W S 4 Date: 12/6/76

Aspect (degrees) N Slope (degrees) 5 Elevation (feet) 7000

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Pin edu	2	M	2	Moderate	100
2	Pur tri	1	M	80	Severe	100
3	Pur tri	2	M	20	Moderate	100
4	Pin edu	1	Y	0	Light	100
5	Pin edu	2	M	0	Moderate	100
6	Pur tri	8	D	-	-	0
7	Pin edu	2	M	0	Moderate	100
8	Pin edu	1	M	2	Light	100
9	Pur tri	3	M	80	Severe	100
10	Art tri	6	D	8	Severe	50
11	Pin edu	1	M	10	Light	100
12	Pin edu	3	M	0	Severe	100
13	Art tri	6	D	0	Severe	50
14	Jun ost	3	M	0	Severe	100
15	Art tri	3	M	0	Severe	100
16	Art tri	1	M	0	Light	100
17	Pin edu	8	D	-	-	0
18	Pin edu	1	S	0	Light	100
19	Art tri	2	M	2	Moderate	100
20	Pin edu	4	M	0	Light	80
21	Art tri	1	M	0	Light	100
22	Sym ore	3	M	0	Severe	100
23	Jun ost	2	M	0	Moderate	100
24	Jun ost	2	M	15	Moderate	100
25	Pin edu	1	Y	0	None	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Mixed Brush Sample Unit #: 6

T 2S R 99W S 6 Date: 12/6/76

Aspect (degrees) S Slope (degrees) 30 Elevation (feet) 7440

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Ame uta	3	M	50	Severe	100
2	Ame uta	3	M	30	Severe	100
3	Pin edu	2	M	0	Moderate	100
4	Sym ore	3	M	0	Severe	100
5	Pin edu	4	M	0	Light	80
6	Ame uta	3	D	0	Severe	100
7	Ame uta	3	M	40	Severe	100
8	Sym ore	1	Y	0	Light	100
9	Cer mon	3	M	85	Severe	100
10	Ame uta	3	M	50	Severe	100
11	Cer mon	3	M	20	Severe	100
12	Ame uta	3	M	75	Severe	100
13	Ame uta	2	M	25	Moderate	100
14	Ame uta	5	D	0	Moderate	50
15	Ame uta	2	M	20	Moderate	100
16	Cer mon	2	M	40	Moderate	100
17	Cer mon	2	M	15	Moderate	100
18	Ame uta	2	M	10	Moderate	100
19	Cer mon	2	M	50	Moderate	100
20	Ame uta	2	M	10	Moderate	100
21	Cer mon	2	M	25	Moderate	100
22	Cer mon	3	M	15	Severe	100
23	Cer mon	3	M	40	Severe	100
24	Cer mon	2	M	40	Moderate	100
25	Cer mon	2	M	20	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 7

T 2S R 99W S 4 Date: 12/6/76

Aspect (degrees) S Slope (degrees) 30 Elevation (feet) 7000

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Pin edu	4	M	5	Light	80
2	Art tri	6	D	0	Severe	50
3	Art tri	5	D	0	Moderate	50
4	Art tri	6	D	2	Severe	50
5	Pin edu	4	M	0	Light	80
6	Jun ost	4	D	0	Light	50
7	Art tri	3	M	10	Severe	100
8	Art tri	3	M	0	Severe	100
9	Art tri	3	M	0	Severe	100
10	Art tri	1	M	0	Light	100
11	Pin edu	4	M	2	Light	80
12	Art tri	3	M	4	Severe	100
13	Art tri	1	M	2	Light	100
14	Jun ost	8	D	-	-	0
15	Art tri	3	M	40	Severe	100
16	Art tri	2	M	0	Moderate	100
17	Art tri	2	M	5	Moderate	100
18	Art tri	2	M	2	Moderate	100
19	Art tri	2	M	15	Moderate	100
20	Pin edu	1	M	0	Light	100
21	Art tri	6	D	5	Severe	50
22	Pin edu	4	M	5	Light	80
23	Pin edu	4	M	20	Light	80
24	Art tri	3	M	4	Severe	100
25	Jun ost	4	M	0	Light	80

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 8

T 2S R 99W S 4 Date: 12/7/76

Aspect (degrees) N Slope (degrees) 60 Elevation (feet) 7120

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	3	M	3	Severe	100
2	Ame uta	1	M	10	Light	100
3	Art tri	6	D	20	Severe	50
4	Art tri	6	M	5	Severe	80
5	Art tri	6	D	2	Severe	50
6	Art tri	6	D	0	Severe	50
7	Art tri	5	D	0	Moderate	20
8	Art tri	8	D	-	-	0
9	Sym ore	3	M	0	Severe	100
10	Art tri	3	M	0	Severe	100
11	Art tri	5	D	0	Moderate	75
12	Art tri	6	M	10	Severe	90
13	Ame uta	2	M	10	Moderate	100
14	Art tri	3	M	0	Severe	100
15	Art tri	8	D	-	-	0
16	Art tri	3	M	10	Severe	100
17	Sym ore	2	M	0	Moderate	100
18	Sym ore	2	M	0	Moderate	100
19	Sym ore	2	M	0	Moderate	100
20	Ame uta	1	Y	0	None	100
21	Art tri	8	D	-	-	0
22	Art tri	3	M	10	Severe	100
23	Art tri	3	M	2	Severe	100
24	Art tri	6	M	0	Severe	90
25	Art tri	6	D	0	Severe	50

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 9

T 2S R 99W S 40 Date: 12/7/76

Aspect (degrees) N Slope (degrees) 10-15 Elevation (feet) 7080

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	5	D	0	Moderate	25
2	Art tri	1	M	0	Light	100
3	Art tri	1	Y	0	None	100
4	Art tri	8	D	-	-	0
5	Art tri	1	M	0	Light	100
6	Art tri	8	D	-	-	0
7	Art tri	1	M	0	Light	100
8	Art tri	1	M	0	Light	100
9	Art tri	2	M	0	Moderate	100
10	Art tri	2	M	0	Moderate	100
11	Art tri	1	M	0	Light	100
12	Art tri	1	M	0	Light	100
13	Art tri	8	D	-	-	0
14	Sym ore	1	M	0	Light	100
15	Art tri	2	M	0	Moderate	100
16	Art tri	6	D	20	Severe	50
17	Art tri	2	M	0	Moderate	100
18	Art tri	8	D	-	-	0
19	Art tri	2	M	0	Moderate	100
20	Art tri	1	M	0	Light	100
21	Art tri	8	D	-	-	0
22	Art tri	1	M	0	Light	100
23	Art tri	2	M	0	Moderate	100
24	Art tri	8	D	-	-	0
25	Art tri	1	Y	0	None	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 10

T 2S R 99W S 4 Date: 12/7/76

Aspect (degrees) N Slope (degrees) 0-5 Elevation (feet) 7040

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	3	M	2	Severe	100
2	Art tri	8	D	-	-	0
3	Art tri	2	M	0	Moderate	100
4	Art tri	6	M	0	Severe	80
5	Art tri	5	D	0	Moderate	60
6	Art tri	2	M	0	Moderate	100
7	Art tri	6	D	2	Severe	75
8	Art tri	6	D	0	Severe	30
9	Art tri	5	D	0	Moderate	30
10	Art tri	2	M	0	Moderate	100
11	Art tri	2	M	0	Moderate	100
12	Art tri	2	M	5	Moderate	100
13	Art tri	2	M	0	Moderate	100
14	Art tri	2	M	0	Moderate	100
15	Art tri	1	M	0	Light	100
16	Art tri	8	D	-	-	0
17	Art tri	8	D	-	-	0
18	Art tri	2	M	0	Moderate	100
19	Art tri	6	D	0	Severe	20
20	Art tri	1	M	0	Light	100
21	Art tri	8	D	-	-	0
22	Art tri	2	M	0	Moderate	100
23	Art tri	5	D	0	Moderate	15
24	Art tri	1	M	0	Light	100
25	Art tri	6	D	0	Severe	40

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 11

T 2S R 99W S 4 Date: 12/7/76

Aspect (degrees) S Slope (degrees) Elevation (feet) 7080

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Jun ost	4	M	10	Light	10
2	Pin edu	5	M	20	Moderate	20
3	Pur tri	8	D	-	-	0
4	Pur tri	2	M	10	Moderate	100
5	Pur tri	3	M	70	Severe	100
6	Pur tri	3	M	50	Moderate	100
7	Jun ost	1	M	5	Light	100
8	Pin edu	5	M	10	Moderate	30
9	Pin edu	5	M	5	Moderate	75
10	Jun ost	5	M	0	Moderate	20
11	Pur tri	3	M	80	Severe	100
12	Pur tri	3	M	75	Severe	100
13	Pur tri	3	M	60	Severe	100
14	Pur tri	3	M	90	Severe	100
15	Pin edu	2	M	1	Moderate	100
16	Pin edu	3	M	20	Severe	100
17	Jun ost	5	M	0	Moderate	15
18	Pur tri	2	M	60	Moderate	100
19	Pin edu	1	M	0	Light	100
20	Pur tri	2	M	60	Moderate	100
21	Pin edu	2	M	0	Moderate	100
22	Pur tri	1	M	70	Severe	100
23	Pin edu	1	Y	0	Light	100
24	Jun ost	4	M	3	Light	5
25	Pur tri	8	D	-	-	0

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 12

T 1S R 99W S 34 Date: 12/7/76

Aspect (degrees) NE Slope (degrees) <5 Elevation (feet) 6800

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Pin edu	7	M	-	Moderate	0
2	Cer mon	3	M	100	Severe	100
3	Cer mon	3	M	75	Severe	100
4	Pur tri	2	M	50	Moderate	100
5	Ame uta	3	M	15	Severe	100
6	Ame uta	3	M	80	Severe	100
7	Pin edu	7	M	-	Moderate	0
8	Pin edu	5	M	0	Moderate	10
9	Art tri	4	D	5	Light	20
10	Cer mon	3	M	95	Severe	100
11	Art tri	4	M	0	Light	75
12	Cer mon	3	M	80	Severe	100
13	Jun ost	1	M	0	Light	10
14	Art tri	2	M	20	Moderate	100
15	Pin edu	5	M	10	Moderate	15
16	Pin edu	7	M	-	Moderate	0
17	Pin edu	7	M	-	Light	0
18	Jun ost	8	D	-	-	0
19	Art tri	2	M	30	Moderate	100
20	Pin edu	6	M	10	Severe	15
21	Cer mon	3	M	90	Severe	100
22	Cer mon	3	M	80	Severe	100
23	Cer mon	3	M	70	Severe	100
24	Pin edu	1	S	0	None	100
25	Cer mon	3	M	60	Severe	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 13

T 1S R 99W S 34 Date: 12/7/76

Aspect (degrees) E Slope (degrees) 1 Elevation (feet) 6600

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	8	D	-	-	0
2	Art tri	4	M	0	Light	35
3	Art tri	1	M	0	Light	100
4	Art tri	1	M	0	None	100
5	Art tri	1	M	0	None	100
6	Art tri	8	D	-	-	0
7	Art tri	4	M	0	Light	25
8	Art tri	1	M	0	Light	100
9	Art tri	1	D	0	Light	75
10	Art tri	1	M	0	Light	100
11	Art tri	1	M	0	None	100
12	Art tri	1	M	0	None	25
13	Art tri	1	M	0	None	100
14	Art tri	4	M	0	None	20
15	Art tri	4	M	0	None	50
16	Art tri	1	M	0	None	100
17	Art tri	1	M	0	None	100
18	Art tri	8	D	-	-	0
19	Art tri	1	M	0	Light	100
20	Art tri	1	M	0	None	100
21	Art tri	1	M	0	Light	100
22	Art tri	1	M	0	None	100
23	Art tri	1	M	0	None	100
24	Art tri	4	M	0	None	80
25	Art tri	4	M	0	None	80

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 14

T 1S R 99W S 33 Date: 12/7/76

Aspect (degrees) SE Slope (degrees) 15 Elevation (feet) 6820

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	1	M	0	Light	100
2	Art tri	1	M	0	None	100
3	Art tri	2	M	0	Moderate	100
4	Art tri	1	M	0	Light	100
5	Art tri	3	M	0	Severe	100
6	Art tri	2	M	0	Moderate	100
7	Art tri	4	M	0	Light	90
8	Art tri	1	M	0	None	100
9	Art tri	2	M	0	Moderate	100
10	Art tri	5	D	0	Moderate	40
11	Art tri	1	M	0	None	100
12	Art tri	3	M	0	Severe	100
13	Art tri	2	M	0	Moderate	100
14	Art tri	1	M	0	Light	100
15	Art tri	2	M	0	Moderate	100
16	Art tri	1	M	0	None	100
17	Art tri	8	D	-	-	0
18	Art tri	1	M	0	Light	100
19	Art tri	1	M	0	Light	90
20	Art tri	1	M	0	None	100
21	Art tri	1	M	0	None	100
22	Art tri	2	M	0	Moderate	100
23	Art tri	6	D	0	Severe	40
24	Art tri	1	M	0	Light	100
25	Art tri	2	M	0	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 15

T 2S R 99W S 5 Date: 12/7/76

Aspect (degrees) S Slope (degrees) 10-15 Elevation (feet) 7040

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	5	M	0	Moderate	90
2	Art tri	2	M	0	Moderate	100
3	Art tri	1	M	0	Light	100
4	Art tri	1	M	0	None	100
5	Art tri	5	D	0	Moderate	50
6	Art tri	5	D	0	Moderate	70
7	Art tri	1	M	2	Light	100
8	Art tri	1	M	0	Light	100
9	Art tri	1	M	0	Light	100
10	Art tri	8	D	-	-	0
11	Art tri	4	D	0	Light	40
12	Art tri	1	M	0	Light	100
13	Art tri	5	D	0	Moderate	75
14	Art tri	8	D	-	-	0
15	Art tri	2	M	0	Moderate	100
16	Art tri	1	M	0	Light	100
17	Art tri	8	D	-	-	0
18	Art tri	4	D	0	Light	20
19	Art tri	5	M	0	Moderate	90
20	Art tri	2	M	0	Moderate	100
21	Art tri	2	M	0	Moderate	100
22	Art tri	2	M	0	Moderate	100
23	Art tri	4	M	0	None	90
24	Art tri	1	M	0	None	100
25	Art tri	1	M	0	None	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 16

T 2S R 99W S 2 Date: 12/7/76

Aspect (degrees) E Slope (degrees) 40 Elevation (feet) 6880

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Pin edu	4	M	3	Light	40
2	Pin edu	2	M	2	Moderate	100
3	Art tri	1	M	0	Light	100
4	Jun ost	4	M	5	Light	30
5	Art tri	4	D	0	Light	15
6	Pin edu	1	S	0	None	100
7	Jun ost	8	D	-	-	0
8	Pin edu	1	S	0	None	100
9	Art tri	4	D	0	Light	65
10	Art tri	2	M	0	Moderate	100
11	Jun ost	5	M	0	Moderate	5
12	Jun ost	8	D	-	-	0
13	Art tri	1	M	3	Light	100
14	Sym ore	3	M	0	Severe	100
15	Sym ore	3	M	0	Severe	100
16	Sym ore	3	D	0	Severe	75
17	Sym ore	2	M	0	Moderate	100
18	Art tri	3	M	2	Severe	100
19	Art tri	4	D	0	Light	50
20	Pur tri	3	M	90	Severe	100
21	Art tri	8	D	-	-	0
22	Pin edu	4	M	5	Light	40
23	Jun ost	1	M	0	Light	100
24	Art tri	6	D	0	Severe	10
25	Cer mon	3	M	90	Severe	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 17

T 2S R 99W S 3 Date: 12/7/76

Aspect (degrees) NW Slope (degrees) 15 Elevation (feet) 6950

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Jun ost	5	M	2	Moderate	20
2	Art tri	1	M	50	Light	100
3	Art tri	2	M	5	Moderate	100
4	Art tri	5	D	0	Moderate	50
5	Art tri	2	M	5	Moderate	100
6	Art tri	2	M	10	Moderate	100
7	Art tri	6	D	15	Severe	20
8	Art tri	1	S	30	Light	100
9	Cer mon	3	M	90	Severe	100
10	Cer mon	3	M	90	Severe	100
11	Pin edu	1	Y	50	Light	100
12	Cer mon	3	M	90	Severe	100
13	Cer mon	3	M	90	Severe	100
14	Jun ost	7	M	-	Moderate	0
15	Jun ost	6	M	1	Severe	10
16	Jun ost	8	D	-	-	0
17	Art tri	6	D	5	Severe	60
18	Art tri	3	M	25	Severe	100
19	Art tri	6	D	50	Severe	10
20	Art tri	3	M	30	Severe	100
21	Pur tri	2	M	85	Moderate	100
22	Cer mon	3	M	95	Severe	100
23	Cer mon	2	M	95	Moderate	100
24	Art tri	6	D	75	Severe	60
25	Cer mon	2	M	60	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 18

T 2S R 99W S 10 Date: 12/7/76

Aspect (degrees) SE Slope (degrees) 1 Elevation (feet) 7100

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Jun ost	7	M	-	None	0
2	Pin edu	3	M	100	Severe	100
3	Art tri	8	D	-	-	0
4	Pin edu	3	M	95	Severe	100
5	Art tri	8	D	-	-	0
6	Jun ost	4	M	2	Light	5
7	Pin edu	5	M	3	Moderate	5
8	Art tri	1	M	50	Light	100
9	Pur tri	2	M	40	Moderate	100
10	Pur tri	1	M	20	Light	100
11	Pur tri	2	M	55	Moderate	100
12	Pin edu	2	M	0	Moderate	100
13	Pur tri	2	M	30	Moderate	100
14	Jun ost	1	D	0	Light	15
15	Pur tri	8	D	-	-	0
16	Jun ost	5	M	0	Moderate	25
17	Pur tri	2	M	60	Moderate	100
18	Pur tri	2	M	50	Moderate	100
19	Pur tri	3	M	80	Severe	100
20	Pur tri	2	M	95	Moderate	100
21	Pur tri	3	M	85	Severe	100
22	Pur tri	2	M	75	Moderate	100
23	Pur tri	2	M	40	Moderate	100
24	Pur tri	3	M	50	Severe	100
25	Jun ost	5	M	0	Moderate	20

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 19

T 2S R 99W S 9 Date: 12/7/76

Aspect (degrees) SE Slope (degrees) 1 Elevation (feet) 7340

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	4	D	0	Light	60
2	Pur tri	2	M	40	Moderate	100
3	Pin edu	1	M	2	Light	100
4	Art tri	1	M	0	Light	100
5	Jun ost	4	M	0	Light	50
6	Jun ost	4	M	5	Light	50
7	Pin edu	1	M	10	Light	100
8	Art tri	2	M	5	Moderate	100
9	Art tri	2	M	10	Moderate	100
10	Pin edu	4	M	5	Light	60
11	Jun ost	4	M	5	Light	75
12	Pin edu	4	M	20	Light	15
13	Art tri	3	M	0	Severe	100
14	Art tri	3	M	0	Severe	100
15	Jun ost	1	M	2	Light	100
16	Pin edu	3	M	30	Severe	100
17	Art tri	2	M	2	Moderate	100
18	Art tri	2	M	0	Moderate	100
19	Art tri	1	M	0	Light	100
20	Art tri	8	D	-	-	0
21	Art tri	4	D	5	Light	30
22	Art tri	6	D	0	Severe	20
23	Art tri	6	D	0	Severe	35
24	Art tri	5	D	5	Moderate	75
25	Pin edu	3	M	50	Severe	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 20

T 2S R 99W S 9 Date: 12/7/76

Aspect (degrees) SW Slope (degrees) 50 Elevation (feet) 7200

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	3	M	50	Severe	100
2	Art tri	2	M	50	Moderate	100
3	Art tri	6	D	40	Severe	75
4	Art tri	3	M	60	Severe	100
5	Ame uta	1	S	0	None	100
6	Art tri	6	D	40	Severe	50
7	Art tri	8	D	-	-	0
8	Art tri	8	D	-	-	0
9	Art tri	2	M	30	Moderate	100
10	Art tri	6	D	20	Severe	65
11	Art tri	3	M	5	Severe	100
12	Art tri	6	D	50	Severe	60
13	Art tri	6	D	10	Severe	75
14	Art tri	6	M	20	Severe	90
15	Art tri	6	D	25	Severe	50
16	Art tri	2	M	20	Moderate	100
17	Art tri	8	D	-	-	0
18	Art tri	6	D	5	Severe	50
19	Art tri	8	D	-	-	0
20	Art tri	1	M	5	Light	100
21	Art tri	2	M	50	Moderate	100
22	Art tri	6	D	5	Severe	50
23	Art tri	6	D	5	Severe	75
24	Art tri	1	M	3	Light	100
25	Art tri	1	M	10	Light	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 21

T 2S R 99W S 9 Date: 12/7/76

Aspect (degrees) W Slope (degrees) 20 Elevation (feet) 7200

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	3	M	75	Severe	100
2	Art tri	6	M	70	Severe	80
3	Art tri	2	M	30	Moderate	100
4	Art tri	3	M	50	Severe	100
5	Art tri	3	M	20	Severe	100
6	Pin edu	2	M	0	Moderate	100
7	Art tri	1	M	10	Light	100
8	Art tri	3	M	75	Severe	100
9	Art tri	6	D	50	Severe	75
10	Art tri	6	D	90	Severe	40
11	Art tri	3	M	90	Severe	100
12	Art tri	6	D	75	Severe	15
13	Art tri	3	M	5	Severe	100
14	Art tri	6	M	75	Severe	80
15	Art tri	3	M	10	Severe	100
16	Art tri	3	M	20	Severe	80
17	Art tri	6	D	15	Severe	75
18	Art tri	6	D	5	Severe	75
19	Art tri	6	D	5	Severe	50
20	Art tri	6	D	35	Severe	65
21	Art tri	2	M	5	Moderate	100
22	Art tri	6	D	5	Severe	50
23	Pin edu	1	M	0	Light	100
24	Art tri	2	M	10	Moderate	100
25	Art tri	6	M	10	Severe	90

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 22

T 2S R 99W S 17 Date: 12/7/76

Aspect (degrees) E Slope (degrees) 7-8 Elevation (feet) 7300

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	2	M	20	Moderate	100
2	Art tri	6	M	5	Severe	80
3	Art tri	2	M	10	Moderate	100
4	Art tri	5	D	30	Moderate	5
5	Ame uta	2	M	0	Light	100
6	Art tri	5	M	25	Moderate	90
7	Ame uta	1	S	0	None	100
8	Art tri	6	D	5	Severe	50
9	Art tri	8	D	-	-	0
10	Art tri	6	D	0	Severe	60
11	Art tri	2	M	5	Moderate	100
12	Art tri	8	D	-	-	0
13	Art tri	5	D	0	Moderate	25
14	Art tri	5	D	0	Moderate	30
15	Ame uta	1	M	0	Light	100
16	Art tri	1	M	0	Light	90
17	Art tri	8	D	-	-	0
18	Ame uta	1	M	2	Light	100
19	Art tri	1	M	5	Light	100
20	Art tri	1	M	5	Light	100
21	Art tri	6	D	0	Severe	10
22	Art tri	3	M	0	Severe	100
23	Art tri	2	M	0	Moderate	100
24	Art tri	6	D	5	Severe	60
25	Art tri	2	M	10	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 23

T 1S R 99W S 13 Date: 12/8/76

Aspect (degrees) NE Slope (degrees) 2-3 Elevation (feet) 6600

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Jun ost	1	M	0	Light	100
2	Art tri	1	M	0	Light	100
3	Art tri	1	Y	0	None	100
4	Art tri	1	Y	0	None	100
5	Art tri	1	M	0	Light	100
6	Art tri	1	M	0	Light	100
7	Art tri	5	D	10	Moderate	20
8	Art tri	5	D	0	Moderate	20
9	Art tro	3	M	10	Severe	100
10	Art tri	5	D	20	Moderate	75
11	Art tri	6	D	5	Severe	50
12	Art tri	3	M	0	Severe	100
13	Art tri	5	M	0	Moderate	90
14	Art tri	2	M	10	Moderate	100
15	Art tri	6	D	45	Severe	75
16	Jun ost	4	M	0	Light	10
17	Art tri	5	D	10	Moderate	20
18	Art tri	6	D	50	Severe	75
19	Art tri	8	D	-	-	0
20	Art tri	2	M	5	Moderate	100
21	Art tri	3	M	20	Severe	100
22	Art tri	8	D	-	-	0
23	Art tri	6	D	0	Severe	5
24	Art tri	4	M	20	Light	80
25	Jun ost	4	M	2	Light	15

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 24

T 1S R 99W S 13 Date: 12/8/76

Aspect (degrees) E Slope (degrees) 1-2 Elevation (feet) 6640

Field Analyst(s): C. V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	5	D	10	Moderate	75
2	Art tri	1	M	10	Light	100
3	Art tri	2	M	5	Moderate	100
4	Art tri	3	M	10	Severe	100
5	Art tri	2	M	20	Moderate	100
6	Art tri	6	D	0	Severe	75
7	Art tri	6	D	0	Severe	25
8	Art tri	5	M	10	Light	95
9	Art tri	5	D	5	Moderate	75
10	Art tri	8	D	-	-	0
11	Art tri	5	D	30	Moderate	30
12	Art tri	5	D	20	Moderate	75
13	Art tri	5	D	20	Moderate	50
14	Art tri	2	M	5	Moderate	100
15	Art tri	8	D	-	-	0
16	Art tri	6	D	0	Severe	15
17	Art tri	6	D	0	Severe	20
18	Art tri	6	D	5	Severe	60
19	Art tri	8	D	-	-	0
20	Art tri	2	M	0	Moderate	100
21	Art tri	1	M	0	Light	100
22	Art tri	8	D	-	-	0
23	Art tri	3	M	30	Severe	100
24	Art tri	3	M	10	Severe	100
25	Art tri	2	M	10	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Pinyon - Juniper Sample Unit #: 25

T 1S R 99W S 13 Date: 12/8/76

Aspect (degrees)_____ Slope (degrees)_____ Elevation (feet) 6640

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Jun ost	4	M	0	Light	75
2	Jun ost	5	D	0	Moderate	50
3	Jun ost	6	M	0	Severe	50
4	Art tri	6	D	50	Severe	75
5	Art tri	1	M	5	Light	100
6	Art tri	6	D	20	Severe	60
7	Art tri	6	D	10	Severe	60
8	Art tri	6	D	10	Severe	50
9	Art tri	3	M	15	Severe	100
10	Art tri	6	D	0	Severe	10
11	Art tri	6	D	5	Severe	65
12	Art tri	5	D	0	Moderate	75
13	Art tri	1	M	5	Light	100
14	Art tri	1	M	0	Light	100
15	Art tri	1	M	5	Light	100
16	Art tri	5	D	0	Moderate	20
17	Art tri	1	M	0	Light	100
18	Art tri	2	M	15	Moderate	100
19	Art tri	5	M	5	Moderate	90
20	Art tri	3	M	10	Severe	100
21	Art tri	2	M	0	Moderate	100
22	Art tri	8	D	-	-	0
23	Art tri	1	M	0	Light	100
24	Art tri	3	M	20	Severe	100
25	Art tri	5	D	40	Moderate	50

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 26

T 1S R 99W S 24 Date: 12/8/76

Aspect (degrees)_____ Slope (degrees)_____ Elevation (feet) 6620

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	2	M	10	Moderate	100
2	Art tri	6	D	20	Severe	65
3	Art tri	8	D	-	-	0
4	Art tri	8	D	-	-	0
5	Art tri	6	D	30	Severe	30
6	Art tri	6	D	10	Severe	40
7	Art tri	6	D	15	Severe	45
8	Art tri	1	M	0	Light	100
9	Art tri	6	D	0	Severe	10
10	Art tri	3	M	0	Severe	100
11	Art tri	1	M	10	Light	100
12	Art tri	1	M	5	Light	100
13	Art tri	3	M	35	Severe	100
14	Art tri	8	D	-	-	0
15	Art tri	3	M	10	Severe	100
16	Art tri	1	M	5	Light	100
17	Art tri	1	M	0	Light	100
18	Art tri	1	M	5	Light	100
19	Art tri	2	M	0	Moderate	100
20	Art tri	1	M	0	Light	100
21	Art tri	5	D	10	Moderate	65
22	Art tri	2	M	10	Moderate	100
23	Art tri	7	M	10	Moderate	100
24	Art tri	8	D	-	-	0
25	Art tri	2	M	10	Moderate	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 27

T 1S R 99W S 24 Date: 12/8/76

Aspect (degrees)_____ Slope (degrees)_____ Elevation (feet) 6520

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	6	M	0	Severe	90
2	Art tri	3	M	15	Severe	100
3	Art tri	2	M	15	Moderate	100
4	Art tri	2	M	20	Moderate	100
5	Art tri	3	M	50	Severe	100
6	Art tri	2	M	30	Moderate	100
7	Art tri	8	D	-	-	0
8	Art tri	6	D	20	Severe	75
9	Art tri	6	D	0	Severe	65
10	Art tri	3	M	30	Severe	100
11	Art tri	6	D	25	Severe	50
12	Art tri	3	M	2	Severe	100
13	Art tri	6	D	20	Severe	60
14	Art tri	3	M	0	Severe	100
15	Art tri	6	D	5	Severe	75
16	Art tri	5	D	5	Moderate	65
17	Art tri	1	M	0	Light	100
18	Art tri	8	D	-	-	0
19	Art tri	6	D	0	Severe	30
20	Art tri	6	M	0	Severe	85
21	Art tri	3	M	0	Severe	100
22	Art tri	2	M	0	Moderate	100
23	Art tri	2	M	10	Moderate	100
24	Art tri	3	M	0	Severe	100
25	Art tri	2	M	10	Moderate	85

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 28

T 2S R 99W S 4 Date: 12/8/76

Aspect (degrees) SE Slope (degrees) 10 Elevation (feet) 7050

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	4	M	0	Light	85
2	Art tri	8	D	-	-	0
3	Art tri	1	M	0	Light	100
4	Art tri	1	M	0	Light	100
5	Art tri	1	M	0	Light	100
6	Art tri	1	M	5	Light	100
7	Art tri	5	D	0	Moderate	75
8	Art tri	4	D	0	Light	75
9	Art tri	1	M	0	Light	100
10	Art tri	1	M	3	Light	100
11	Art tri	2	M	0	Moderate	100
12	Art tri	1	M	0	Light	100
13	Art tri	4	D	5	Light	75
14	Art tri	2	M	0	Moderate	100
15	Art tri	4	D	0	Light	70
16	Art tri	4	M	15	Light	90
17	Art tri	4	D	0	Light	60
18	Art tri	1	M	2	Light	100
19	Art tri	4	D	5	Light	50
20	Art tri	1	M	5	Light	100
21	Art tri	4	D	0	Light	60
22	Art tri	1	M	0	Light	100
23	Art tri	1	M	5	Light	100
24	Art tri	1	M	2	Light	100
25	Art tri	8	D	-	-	0

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 29

T 1S R 99W S 34 Date: 12/8/76

Aspect (degrees) SW Slope (degrees) 1-2 Elevation (feet) 6700

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	1	M	30	Light	100
2	Art tri	2	M	10	Moderate	100
3	Art tri	1	M	10	Light	100
4	Art tri	2	M	5	Moderate	100
5	Art tri	1	M	5	Light	100
6	Art tri	2	M	30	Moderate	100
7	Art tri	1	M	0	Light	100
8	Art tri	1	M	10	Light	100
9	Art tri	2	M	30	Moderate	100
10	Art tri	3	M	10	Severe	100
11	Art tri	1	M	0	Light	100
12	Art tri	2	M	0	Moderate	100
13	Art tri	2	M	25	Moderate	100
14	Art tri	1	M	20	Light	100
15	Art tri	1	M	50	Light	100
16	Art tri	1	M	75	Light	100
17	Art tri	2	M	50	Moderate	100
18	Art tri	1	M	0	Light	100
19	Art tri	2	M	25	Moderate	100
20	Art tri	1	M	0	Light	100
21	Art tri	5	D	20	Moderate	50
22	Art tri	6	D	50	Severe	50
23	Art tri	3	M	0	Severe	100
24	Art tri	3	M	0	Severe	100
25	Art tri	3	M	20	Severe	100

BROWSE CONDITION AND UTILIZATION DATA SHEET

Vegetation Type: Sagebrush Sample Unit #: 30

T 2S R 99W S 2 Date: 12/8/76

Aspect (degrees) NW Slope (degrees) Elevation (feet) 7020

Field Analyst(s): C.V. Braun

No.	Species	Form Class	Age Class	Leader Use (%)	Hedging Class	Availability(%)
1	Art tri	2	M	0	Moderate	100
2	Art tri	3	D	50	Severe	70
3	Art tri	6	D	0	Severe	40
4	Art tri	2	M	40	Moderate	100
5	Art tri	2	M	50	Moderate	100
6	Art tri	6	D	60	Severe	50
7	Art tri	2	M	30	Moderate	100
8	Art tri	2	M	20	Moderate	100
9	Art tri	2	M	10	Moderate	100
10	Art tri	2	M	30	Moderate	100
11	Art tri	1	M	0	Light	100
12	Art tri	5	D	0	Moderate	50
13	Art tri	1	M	10	Light	100
14	Art tri	6	D	10	Severe	75
15	Art tri	2	M	0	Moderate	100
16	Art tri	2	M	0	Moderate	100
17	Art tri	1	M	25	Light	100
18	Art tri	3	M	0	Severe	100
19	Art tri	3	M	0	Severe	100
20	Art tri	6	D	0	Severe	10
21	Art tri	6	M	20	Severe	80
22	Art tri	1	M	0	Light	100
23	Art tri	2	M	0	Moderate	100
24	Art tri	1	M	10	Light	100
25	Art tri	1	M	5	Light	100